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EVERYTHING PNEUMATIC.

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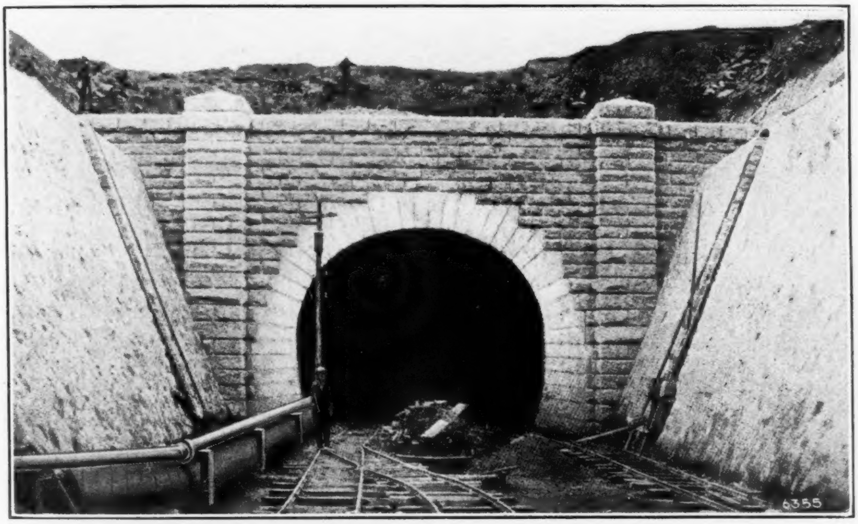


FIG. 1. PORTAL OF MT. IKOMA TUNNEL.

DRIVING A DOUBLE TRACK TUNNEL IN JAPAN

By W. L. Saunders.

The Japanese people have given us many evidences of their progressiveness, but nothing emphasizes their spirit of progress more than the work which they are now doing in building a double track, broad gauge electric railway between Osaka and Nara. Osaka has been called the Pittsburg of Japan. It is the commercial metropolis, with one million inhabitants, covering an area of more than eight square miles, intersected by the river Yodo and with numerous canals running through it. Osaka is admirably situated for a manufacturing city. Its principal trade is with China. On arriving at Osaka one is impressed by its industrial activities, as illustrated by the large number of chimneys. Old Osaka has left its monument in the great Castle, built by Taiko Hideyoshi in 1583. Little remains of the old Castle but the ruins, and principally the walls of the moat. These walls contain huge blocks of hard granite, some of them measuring 40 feet in length and 16 feet in height.

From Osaka to Nara is from new to old Japan, for Nara is in every respect representative of what Japan used to be. It was the ancient capital during seven reigns and until the seat of government was removed to Kyoto. At Nara is the largest statue of Buddha, built in the year 746.

The railway now under construction is a short cut designed to reduce the time of travel and the mileage. The line runs through Mt. Ikoma, which is located about half way between Osaka and Nara.

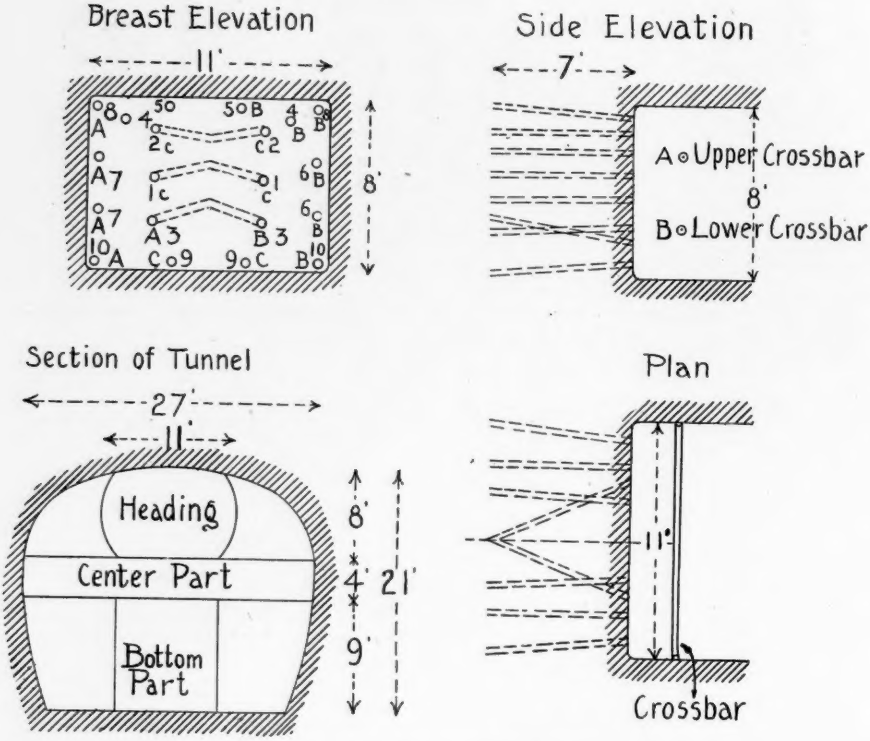


FIG. 2. SHOWING DRILLING LAYOUT.

The contract for the construction of this tunnel was awarded to Obayashi Gumi, the engineering work being in charge of Dr. Eng. T. Oka. The tunnel work begins in the eastern end at Ikoma Village, extending westwardly to Hineichi Village, a distance of about two miles. The finished dimensions of the complete tunnel are 22.2 ft. in width by 19.35 ft. in height. Work was begun on the 3rd of July, 1911, and is now being prosecuted from the two portals.

The attached sketches and plans, Fig. 1, show the methods pursued in this work. The upper sketches represent the heading, one being an elevation showing the breast and the other a vertical section or elevation through the heading. The lower sketch to the left is a section across the tunnel, illustrating the entire width and height and showing the heading in the upper central part with the center prism separating the heading and the bench or bottom part.

To the right and to the left of the heading and to the right and to the left of the bench are sections which are excavated by the use of stoping drills. The center prism is also removed in the same manner. The plan to the right of this section shows the cross-bar used for mounting the drills in the heading.

The heading is 8 ft. high and 11 ft. wide; the center part is 4 ft. high and 27 ft. wide; and the bottom part or bench is 9 ft. high and 8 ft. wide.

In the heading a bar 5 inches in diameter and 10 ft. in length is fixed horizontally across the tunnel. Jack screws, located in each end of this bar, serve to adjust it to proper lengths and to fix it rigidly against the walls. Three water-Leyner drills are mounted on this bar, and the upper holes are drilled first. Then the bar is lowered to a point nearer to the bottom of the heading and the lower holes are drilled.

Because of the use of these light weight drills, which do not kick hard against their mounting, it is possible to employ this bar in place of the usual columns. Columns with arms are mainly used in America because

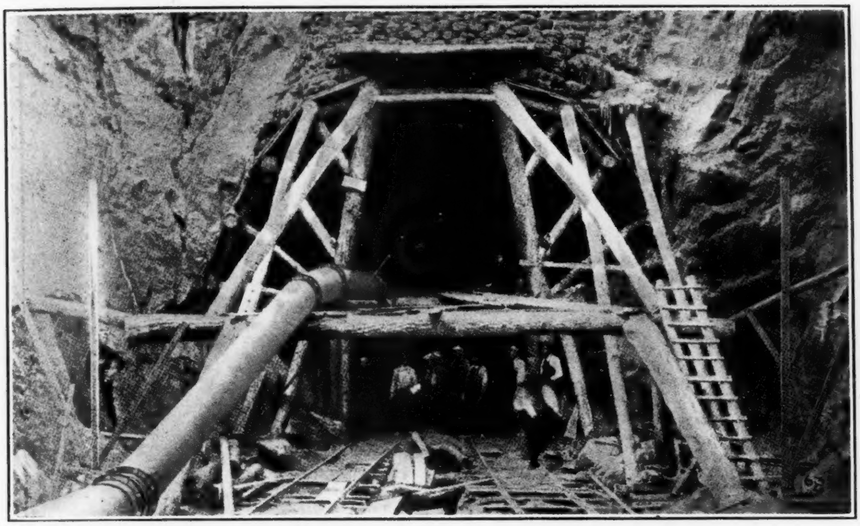


FIG. 3. SHOWING VENTILATING PIPE.

drills of the percussion type require a very rigid mounting. It is obvious that the use of the horizontal bar facilitates the handling of the drills and makes it possible to set up after a blast quicker than by the use of columns. The whole thing with the drills mounted is handled readily by a gang of men, who climb up over the muck, placing the bar in position and drilling the holes while the muckers are at work below them.

The center or cut holes are drilled to a depth of 8 ft., all the other holes being 7 ft. in depth. Blasting is done by time fuse, which is admitted nowadays to be the best practice. Gelatine is placed in the bottom of the hole next the primer, over it is placed some gelatine and them 60 per cent. dynamite. Clay is used for tamping. Where the rock is hard from 22 to 26 holes are drilled in the heading, but in softer rock this number is reduced to 16

FIG. 4. DRILLS AND JAPS AT HEADING.

holes in some cases and in others as low as 12 holes. The rock in Mt. Ikoma is granite, usually hard, especially in the east end.

Progress in this tunnel has averaged over 10 ft. of heading per day. Records have been made of 20 ft. in 24 hours, single heading. This was on the west side where the rock is of moderate hardness. It usually requires five hours to drill 20 holes, 6 ft. to 7 ft. deep. The work of loading, firing and taking out the rock consumes about three hours, or a total shift of 8 hours, the miners working day and night. One superintendent is in charge of each heading, with three drillers and three helpers.

Mine cars of wood are used, with a carrying capacity of 30 cubic feet; track 30 inch gauge, 25 lb. rail, the train of 10 cars being hauled by an electric locomotive.

For ventilation 50 H. P. Root blowers draw the air through a 20-inch pipe. Both the compressed air pipe and the ventilation pipe are seen in the half-tones, which require no other remark. Ingersoll-Rand Air Compressors of 115 H. P. each furnish the compressed air at 100 pounds pressure, the air being conducted to the heading through a 5 inch pipe.

The holes drilled are usually about 2 inches in diameter and the progress of the drills is from 7 to 12 inches of hole per minute. Although water is fed into the bottom of the hole the discharge of the cuttings is really effected by compressed air, which is forced in with the water, the minimum amount of water being used and only for the purpose of laying the dust.

Power at the portals of the tunnel is transmitted electrically a distance of 16 miles at 3500 volts; 16 candle-power electric lamps are used for lighting. Up to May 31, 1912, an advance was made in the east end of 2127 ft. and in the west end 1917 ft., or a total progress of 4044 ft. The tunnel is to be lined with brick, about 1000 ft. being already completed.

DRILL STEEL

Much has been written pertaining to the results achieved by drills of modern design. Little, however, has been published in regard to the steel of which the drills bits are made. The time has now come when any further increase of drill power must be attended by the use of stronger and better steel, for even some of the machines now in use strike so hard a blow that trouble is frequently experienced from the bending of the best grades of high-carbon drill steels, or under the shower of rapid blows of the air-hammer drill the phenomenon called "crystallization" causes annoyance through the breaking of cutting edges and shanks of the bit.

There has been a tendency even among the contractors to dispense with use of large steel, and inch or 1¼-in. steel is now the standard in most drilling work. The hollow steels, particularly the round section, are gaining favor, and their adoption is rapidly extending. The star or cross-section is highly esteemed in the West, because of the greater clearance afforded for the ejection of cuttings.

The air-hammer drill has been a stimulus to steel manufacturers to produce a higher quality of material, and some are now investigating the merits of alloy steels. One company has already placed a vanadium steel on the market and a Western company has given an order for a consignment of chrome steel for experimenting with drill bits of that material. It is a growing opinion that these alloy steels will ultimately be proven not only to be superior to ordinary drill steel, but absolutely necessary if more powerful machines are built. At present however, alloy steels for drill bits have not been proven to be better than the best American and Swedish drill steels.—*Eng. and Min. Journal.*

A NEW ALTITUDE RECORD

On September 17th Georges Legagneux made a new record for altitude for monoplanes at the Villacoublag aerodrome, attaining a height of 5,720 meters, or more than 3½ miles. His feat was rendered possible, in a way, by the use of oxygen, and this not for himself but for the motor. The first thousand meters were ascended in two and a half minutes; the next two stages of one thousand meters required five minutes each; the four thousand meter mark was reached in seven and a half minutes more; and the five thousand meter mark was attained in the next fifteen minutes. The full height of five thousand seven hundred and twenty meters was attained in forty-five minutes, which is rather quick work as climbing goes. The descent from a height of more than three and a half miles was made in less than ten minutes. Above a height of 10,000 feet motors work with great difficulty and soon stop. In submarine boats, too, the motors stop long before the crew begin to feel any evil effects from the exclusion of oxygen.

SHAFT UPRAISING PROFITABLE

BY LUCIUS L. WITTICH.

Both in point of time and of money a great saving was accomplished on the property of the Nowata Lead and Zinc Company, at Duenweg, Mo., when a new shaft was made by driving an upraise to the surface. H. Correll, manager of the company, undertook the work of upraising on his own responsibility after having received bids for sinking the shaft by contract. The lowest contract bid received was $15.50 per foot, for a shaft 5 ft. x 7 ft. in the clear, put down to a depth of 210 feet. This would have meant an expenditure of $3,-255, to say nothing of the greater time required. Although the upraising was purely an experiment, the first instance of the kind in the Missouri-Kansas-Oklahoma district, and although many unforseen difficulties arose which can be remedied in subsequent operations of a similar nature, the aggregate cost of upraising the shaft was only $1,273.58, or $6.06 per foot. This saving of $1,981.42 has convinced the company that where it is possible to start at the bottom, that is the wise course to pursue. The company has started a second upraise for a shaft, and it is safe to prophesy that the cost figures will show a still greater saving.

The existence of a 6-inch drill hole at a point where his company desired to sink a new shaft caused Mr. Correll to consider the advisability of using the hole as a medium through which a cable could be passed, to support a working platform at the lower end. Fig. 1 shows the plan adopted in upraising for the shaft. At the top, near the drill hole opening, was stationed a hoister, which was operated so little of the time that an expenditure of 50 cents a day for natural gas for fuel defrayed the cost As this was a minimum flat rate it was in excess of what would have been charged had only the gas really used been paid for. The drill hole extended into the drifts of the mine, the distance from the surface to the roof of the drift where the drill broke through being 210 feet. Through the drill hole was lowered a ⅝-inch cable, which passed over a pulley in a derrick and thence to the hoister.

At the lower end, the cable was attached to a specially constructed platform, built of 2"x 4" and 4"x4" oak lumber, the size of the platform being 4 ft. 8 in. x 6 ft. 8 in., thus leaving 2 inches in the clear, all around, when the platform was hoisted into the upraise. The aggregate weight of the platform, operators, and equipment was 800 pounds, divided as follows: stoping drill, 110 pounds; steel, 50 pounds; two operators, 300 pounds; platform, 340 pounds.

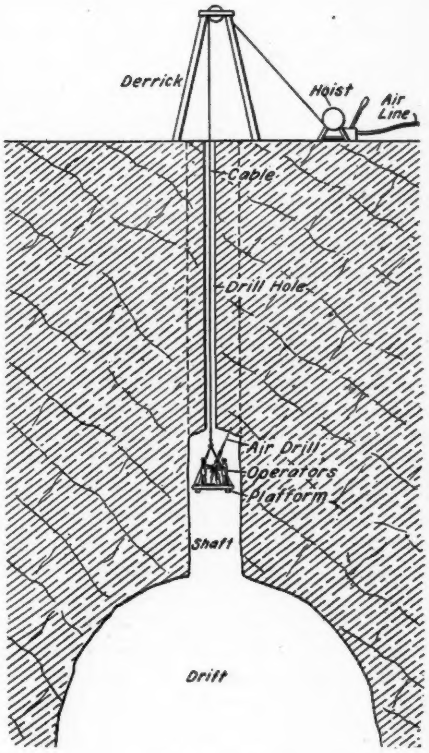


FIG. 1.

Starting the shaft in the roof of the drift was much the same as starting it in solid ground at the surface. The 5'x7' space was marked out, with the drill hole as its center, and the work of shooting down the rock started. The platform was supported by four iron bars, fastened at the corners of the platform, and meeting at a point above the center, high enough to permit the operators to work freely. A hook permitted the cable to be detached from the platform; thus when shots were fired the platform was lowered to the floor of the drift and pulled to a point of safety to be out of the way of falling rock, while the detachable cable was hoisted up the drill hole in order that it might not be damaged by the blast.

From the time the first round of shots was

placed in the roof of the upraise until the shaft was completed, cribbing being included, fifty-two 8-hour shifts were required. This was about a third of the time usually required for sinking a shaft of similar dimensions. The cribbing was installed from the bottom up.

In upraising, 14 holes were driven to a depth of 5 feet in the roof, as shown in Fig. 2. Six of these corresponded to the ordinary sump holes used in sinking a shaft from the top down, while eight corresponded to the cut holes, four of these being driven near the corners and four along the edges, midway between the corner holes. Each hole was loaded with four sticks of dynamite, a total of 56 sticks for one charge. Forty-per-cent. dynamite was used. During the upraising of the first 100 feet the shots were fired from below, the electrical shot firer being stationed in a drift. During the remainder of the work, the shots were fired from the surface. A signal cord down the drill hole enabled the operators to signal to the hoisting engineer.

The 18 feet of surface soil was shot down at a single blast, the drill hole being plugged at the bottom and loaded with dynamite. The result of the blast was an opening more than large enough to accommodate an ordinary mine bucket, and in this bucket workmen were lowered and the edges blasted out and trimmed. It was this final step that Mr. Correll considers his one big mistake. He believes matters could have been expedited by first sinking from the surface down to the hard limestone, then beginning the upraise. As it was, an enormous mass of surface dirt was shot into the drifts when the surface was blasted down, and this became a sticky mass following a heavy rain. It was almost impossible to remove it, and as a result much valuable time was lost. The surface caved, also, to some extent, but heavy concrete walls were built down to the limestone, thus making it secure.

The upraising method has many advantages over the former methods of shaft excavating employed in the district. Ordinarily in shaft sinking the necessity of removing the pumps before each blast, or the necessity of at least covering them with heavy timbers, is of greatest importance. Repairs are constantly being made to the pumps as the result of damage from the shots. Water is invariably rising in the sump and the workmen have an unsani-

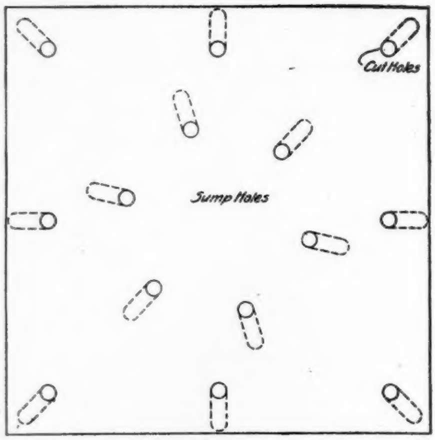


FIG. 2.

tary place in which to toil. As virtually all of the larger mines of the district frequently used from one to half a dozen extra shafts, exclusive of the mill shaft, and as the underground workings usually connect, the possibility of making an upraise is found on every hand.

The cost item of $1,273.58 includes the fuel, wages, powder, timbering, every feature in fact of the work; it even includes the purchase price of the stope drill, $135. However, it does not include the cost of sinking the 6-inch drill hole, which was already at hand. If it had been necessary to sink such a hole, the added cost would have been 80 cents per foot, including the casing, meaning a total of $168 to be added to the figures already given. Many mines, however, have their drill holes already sunk, that can be used as was the one of the Nowata company.

At all times the ventilation was good, as the fumes quickly lifted through the drill hole. In this respect the method is even better than the methods of upraising employed in many of the western mines, where pens are built to hold the working platforms. In such cases the air may become foul at the highest point of operation. *Mines and Minerals.*

Beware the blandishments of the scientific management expert who can look at the tongue of your wagon, feel the pulsations of your boiler feed line, take the temperature under your collar, and prescribe off-hand a sure-cure system, whose principal principle is "change everything."—*Chained Lightning,* Louisville Ltg. Co.

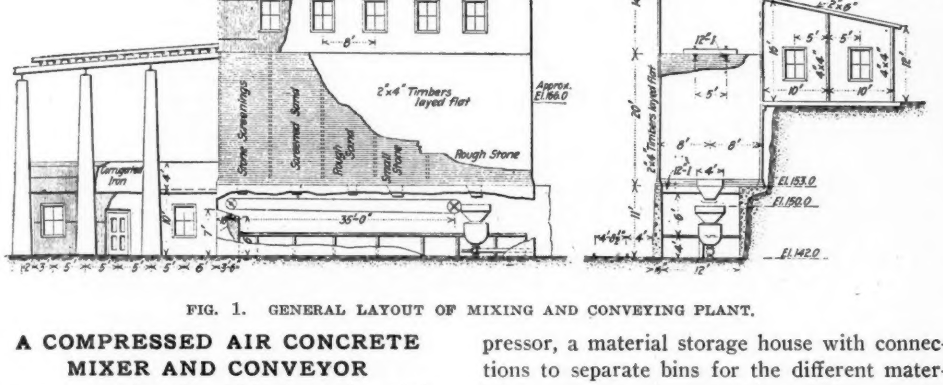


FIG. 1. GENERAL LAYOUT OF MIXING AND CONVEYING PLANT.

A COMPRESSED AIR CONCRETE MIXER AND CONVEYOR

A concrete plant in which the entire mixing and conveying operation is carried on by the use of compressed air has been in successful operation for some time on the McCall Ferry power plant of the Pennsylvania Water & Power Co., at Holtwood, Penn. This power house, was originally designed for 10 hydro-electric units, but it was put in operation with only five such units. The projected increase in size is now being made and requires not only the installation of new turbines, but also the construction of that part of the power house.

The new structure is being built by the company with its own forces under the direction of L. H. Eichelberger, the construction superintendent, and the design and operation of the compressed-air mixing and conveying plant are due to Mr. Eichelberger.

The plant consists essentially of an air compressor, a material storage house with connections to separate bins for the different materials, an automatic measuring device, an inclosed tank into which the materials and water are placed to be mixed by the agitation of a compressed-air stream and a delivery pipe leading from this tank to the place of deposit. The compressors, storage house and mixer are permanently located at a place convenient to the railway siding so that material may be easily brought there, but the delivery pipe can be led to any place on the work where it is required.

DESCRIPTION OF PLANT.

Figs. 1 and 2 show the general layout of the plant. At the extreme left is the compressor with pipes leading to the mixer as shown. The mixer is located under the storage house in line with the hoppers from the various material bins, which hoppers empty upon an electric motor driven belt conveyor, which de-

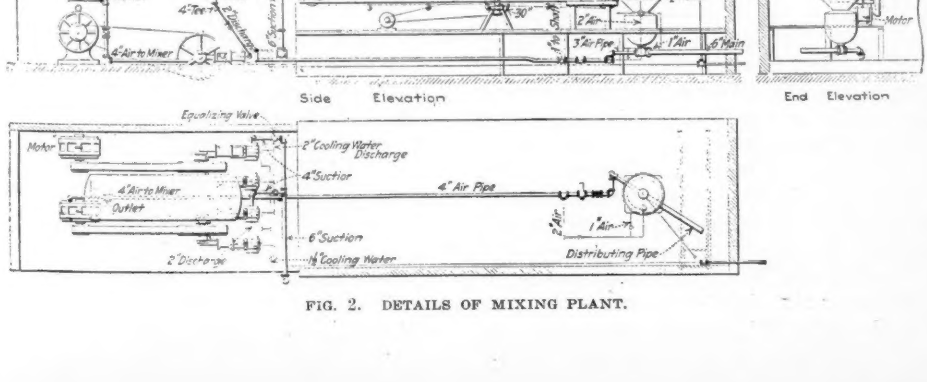


FIG. 2. DETAILS OF MIXING PLANT.

livers the materials to the upper hopper of the mixer.

The storage house is shown in Fig. 1. At the bottom of each bin is a hopper as detailed in Fig. 3 for some of the bins. These hoppers are built so as to contain units or multiples of a unit amount. The rough-stone and small-stone hoppers contain twice as much as the sand or screening hoppers, and the unit is twice the contents of a sack of cement, so that for the mixture used in the work, 1:2:4, the sand hopper and the stone hopper each is filled once to form the proper mixture.

Each of these hoppers is closed at its upper part by a gate sliding horizontally, with all the gates actuated by a single horizontal shaft leading to a piston at the extreme right, as shown in Fig. 3. Each of the gates is connected to this shaft by a slip bolt. The piston is in connection with an air pipe leading from the compressor tank, so that by pulling the lever by the side of the mixer the proper gates, which have been locked by the slip bolt, are opened and the hoppers are filled to the proper amount. The operator can then close them by shoving back the lever. In mixing the concrete different materials are used in different parts of the work and the operator empties the hoppers designated for the particular work in hand by pulling the radial bottom door, shown in Fig. 3. At the same time, the cement, which is stored in sacks at the extreme right of the storehouse as shown, is led to the mixer by a chute from above and the water is fed from a barrel immediately alongside the mixer. In feeding the mixer, therefore, the one man controls the material from his place by the mixer and an exact proportion is assured. The mixing tank shown in Fig. 4 is the one in use at the McCall Ferry plant. The mixer consists of a conical upper hopper leading through an opening, which can be tightly closed, into a lower tank where the mixing operation takes place. This lower tank in the original design is a cylinder joined above a hemisphere with an opening at the bottom through which the material is delivered to the conveying pipe. It is built of wrought iron, 3/8-in. material being used for the tank, hopper and doors and 1/2-in. material for the top head of tank. It was tested before use to stand 175 lb. per sq. in. pressure.

In addition to the main entering pipe, shown at the upper right-hand shoulder of the lower tank, through which the main force of the air is applied, there are a number of holes tapped for 1/2-in. pipe in the upper shoulder and the lower part of the periphery of the tank. In these holes are placed 1/2-in. pipe turned on an angle so as to deliver air in a circumferential line, thus causing a whirling motion of the material inside the tank. These pipes are all connected to one of the lines of pipe from the compressor, though this connection is not shown in the drawing. The bottom of the tank is not closed by a gate, but opens directly into the conveying pipe, which, however, takes a right-angle turn to a horizontal position immediately below the tank. In line with this conveying pipe is a 3-in. pipe from the compressor, which operates as noted below, to force the mixed concrete along the pipe.

In operation the material is dumped by the belt conveyor, as noted above, into the upper hopper, which is closed tight with the cone valve shown. When the materials have been placed in the hopper the cone valve is dropped, by a horizontal lever (not shown in drawing) connecting to the vertical rod attached to the valve, into the lower hopper and the valve is closed at the same time air is turned on to the main 2-in. pipe in the upper right-hand shoulder of the tank and to the small whirling jets noted above. The whirling jets tend to mix the material, while the air from the 2-in. pipe forces the concrete into the conveying pipe directly in front of the 3-in. air jet below, which blows the material through the conveyor pipe to the end of the line.

The conveyor pipe in use on this mixer at McCall Ferry is the ordinary 6-in. wrought-iron pipe, flange connected. On leaving the mixer it takes a slight curve in a horizontal plane and continues for some 300 ft. approximately level to a juncture point where it is led to the different places needed on the work. At this juncture point there is a vertical pipe leading to the top of the power house about 100 ft. above the level of the lower pipe and a horizontal continuation leading to the penstocks and turbine settings. For the end of the delivery pipe originally a box with a curved surface opposite the end of the pipe was devised, but it was soon found that it was just as easy to use a 14-in. T joined to the end of the 6-in. pipe with the horizontal branch opposite the delivery end closed with an iron plate, backed on a wood bulkhead. The material hitting this end soon built up a small cushion of concrete and formed a natural

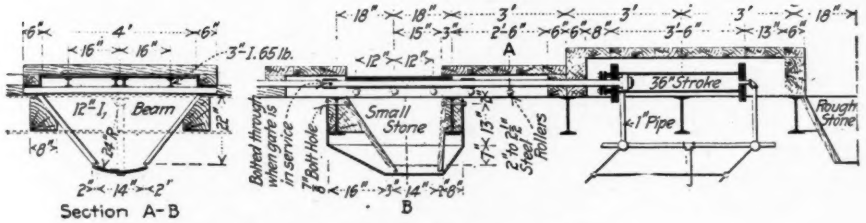


FIG. 3. DETAILS OF HOPPERS AND GATES.

curve around which the concrete was delivered to the vertical drop pipe of the T.

OPERATION OF PLANT.

When the concrete plant was first installed there were available only two compressors, each having a capacity of 300 cu. ft. at 100 lb. pressure, and in addition to the concrete plant a number of drills and repair-shop machines had to be run. Since then another compressor has been installed, so that the machine may be worked to its full capacity. The rated capacity of the mixer is ½ cu. yd., and, working at a minimum distance of 380 ft. with a maximum of 490 ft., the machine has uniformly been mixing and conveying at the rate of 40 batches, that is, 20 cu. yd., per hour. It probably could do better than this if more air were available, as the speed of delivery is only restricted by the speed of getting the materials out of the hoppers into the mixer.

For this work the gang consists of one foreman and five laborers, three of whom are required to operate the mixer. The fourth is used at the discharge end of the pipe as a signal man and for the cleaning of the chute, and the fifth man spades the concrete in the forms. There is a reverse-acting electric signal provided at the mixer and the place of the deposit. When the mixer foreman receives the signal from the other end of the line he lifts the cone valve on the mixer and the mixed material is delivered within 30 sec. to the other end of the pipe. About every 20 batches the pipe is blown through without any material, so as to clean out any concrete which may have lodged at various points along the line.

The concrete delivered is of uniform consistency and appears to be a remarkably dense mixture, although the period of mixing is so short. The large-size stone used on most of the concrete will pass a 3-in. ring, so it will be seen that the mixer and conveyor is for concrete and not for grout alone.

Up to the time when 2200 yd. of concrete had been placed there was no apparent wear on the mixer itself or on the straight part of the 6-in. delivery pipe. At the curve of the delivery pipe, however, the outer surface seemed to wear very rapidly, and a design has

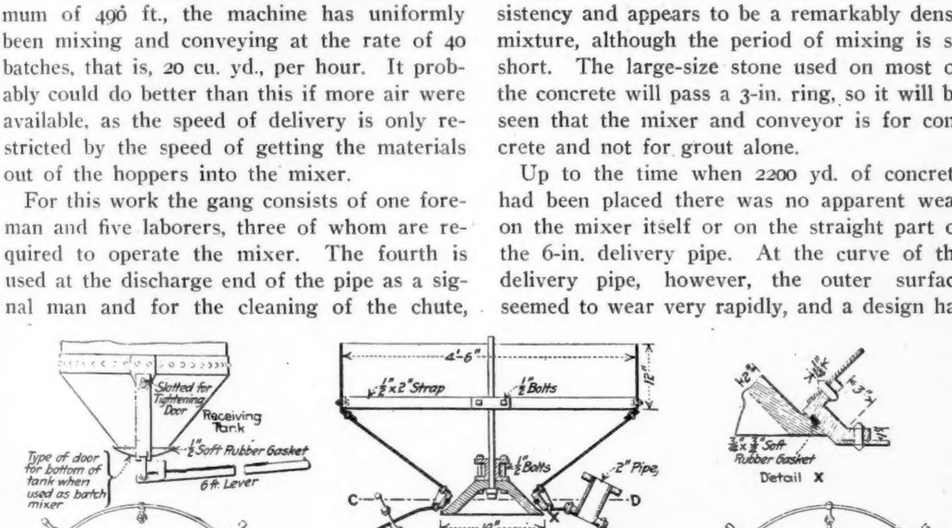


FIG. 4. DETAILS OF MIXER.

been made in which the outer surface is provided with a flange, which can be replaced from time to time. There seems to be no difficulty in raising the concrete to a height of 100 ft., and the delivery at that point is equally efficient and rapid with that on a horizontal line from the mixer.

The mixer was first designed as a batch mixer to deliver directly from its bottom opening to buckets and conveyed by the usual derrick or car methods. Mounted and operated for such a batch mixture, it is placed higher and the large bottom T removed and replaced with the swinging door detailed in Fig. 4. This door holds the materials in the mixer until air is admitted through the mixing jets for a duration of about 10 seconds. The air is then shut off and the door opened to release the mixed concrete. In this way only a small amount of air is required.

The advantages claimed for the device are rapid and economical mixing, together with very economical delivery. In addition for such work as is being done at Holtwood the presence of the usual derricks or car tracks would seriously interfere with the form work and the operation of the present plant. On the other hand, the delivery pipe can be easily led wherever required without interfering with any existing work.—*Engineering News.* (Abridged.)

SUCTION DREDGES IMPROVE THE GULF PORTS

Comparing the conditions at the American ports of the Gulf of Mexico with conditions ten years ago, it is seen that a marked impulse to port development has been involved in the perfection and construction of suction dredges, for these dredges have demonstrated their immense usefulness in accomplishing two results in one effort, namely, the making of new land by the deepening of channels. At Galveston this is evidenced in the increasing area of Pelican Island, which now serves as a protection for Galveston Harbor against the influences of "northers" blowing across Galveston Bay; at Mobile, where several new islands have been brought into existence, whose ownership and control is now being sought from the State of Alabama by the City of Mobile; and at Tampa, where a large marsh area lying to the westward of Ybor City is being transformed into solid land through the cutting of the estuary at Tampa. The possibilities of port development as influenced by suction dredges seem to be almost unlimited around the Gulf, owing to the softness of the average material to be dredged and the absence of any necessity for laborious dredging through rocky material. This is particularly noticeable in Mobile Bay and River. The channel to Mobile, which was about 7 feet deep immediately after the Civil War, has gradually been deepened in the interval to more than 23 feet, with 27 feet in sight. This deep channel stops at a short distance above Mobile and then rapidly shoals until it reaches Spanish Fork, beyond which point, if the intervening area is dredged, it is possible to get into deep water ranging from 30 to 60 feet and running 40 miles northward on the Alabama River.

WATER JACKET TROUBLES

"Most city water contains large quantities of lime and magnesia in solution and these coming in contact with the heated walls of the air compressor precipitate in the form of scale. This scale cuts down the radiating capacity, the air compressor overheats and the efficiency is very greatly reduced. Not only this; but, due to the pressure, the water in the jackets has been known to leak through the packing and get into the cylinders, causing wet air with its attending troubles."

The above is from an exchange which need not be identified. It is a fact that water jackets will not and do not keep clean of themselves, but require cleaning out with a frequency determined by the condition of the water used. As there is practically no evaporation there is little or no deposition of scale as in a steam boiler, but mud or sediment sometimes accumulates rapidly, so that the clearest water obtainable should be used.

The last sentence of the above paragraph is absurd. There is generally no pressure upon the water circulating in the water jacket, never it may be said, as much as within the air cylinder, and in most constructions—packing or no packing—there is no possible communication between the water jacket and the cylinder interior. When there is "wet air with its attending troubles" the water is carried in by the air itself, and there is never any absolutely dry free air taken in.

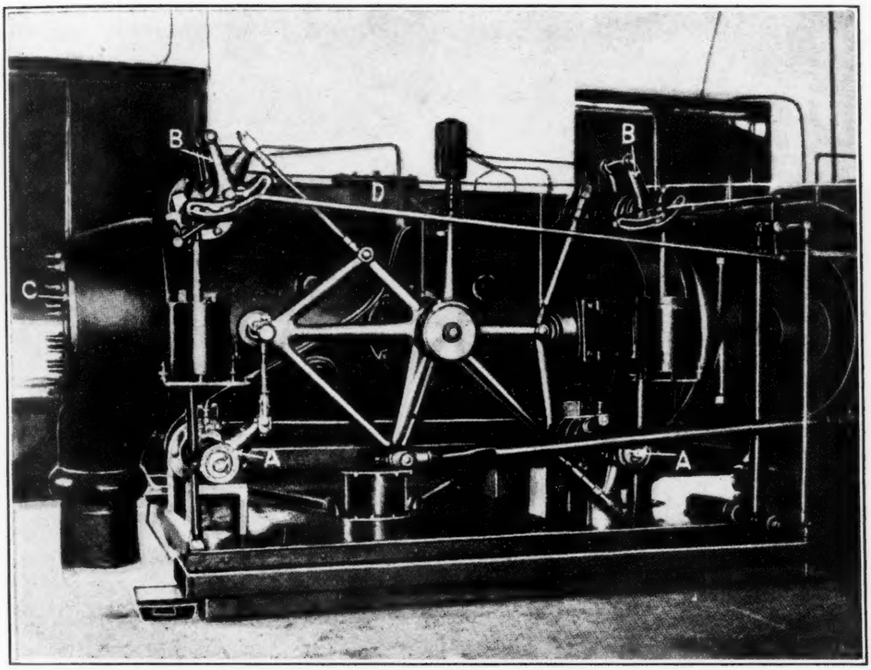


FIG. 1. AIR CYLINDER FRANKLIN HOISTING ENGINE.

THE FRANKLIN AIR-BALANCED HOIST

By R. H. Corbett.*

This hoisting engine was built in conformity with the ideas of R. M. Edwards, general manager of the Franklin Mining Co., and the other Dow properties in the Lake Superior copper district. Mr. Edwards long held the opinion that for deep mining operations a single-compartment shaft would be desirable, provided that a balance hoisting engine could be built to operate a single skip or cage, he considered that the simplicity of a single-compartment shaft and its equipment would warrant any complication of the hoisting engine which would produce the desired result. It was apparent to him that if the power developed by the descending skip could be applied to compressing air it would furnish a solution of the problem.

AIR PISTONS RUN FREE WHILE HOISTING

When the time arrived for ordering a hoist, the matter was placed in the hands of Bruno V. Nordberg to design an engine and work out the details of an air-balanced hoist to meet the requirements. Following this the engine under discussion was built by the Nordberg Manufacturing Co., of Milwaukee, Wis. This hoisting engine is a horizontal-duplex machine with the steam cylinders attached to the frames. The air-compressing cylinders are located immediately back of the steam cylinders. The air pistons are attached to extensions of the steam piston rods, the whole forming a complete hoisting engine and air compressor combined. Means are provided for allowing the steam pistons to run free while lowering the skip. The air pistons run free while hoisting. The engineer regulates the speed of the descending skip by controlling the quantity of air compressed. By means of the operating lever on the platform he absolutely governs the work done in the air cylinders between the limits of full cylinder capacity and no load.

The air compressing cylinders, Fig. 1, have four Corliss valves. The two lower ones *A* admit free air to the cylinders in the usual way. The two upper ones *B* are provided especially for regulating the capacity and are the ones controlled by the engineer while lowering. The air delivered under pressure passes

*Lake Superior Mining Institute, Houghton, Mich., August, 1912.

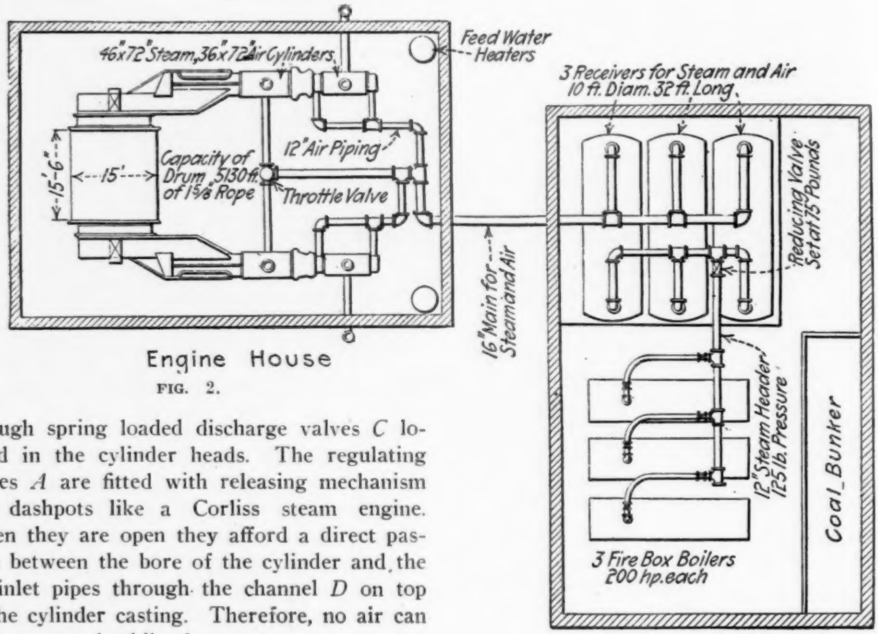


FIG. 2.

through spring loaded discharge valves *C* located in the cylinder heads. The regulating valves *A* are fitted with releasing mechanism and dashpots like a Corliss steam engine. When they are open they afford a direct passage between the bore of the cylinder and the air inlet pipes through the channel *D* on top of the cylinder casting. Therefore, no air can be compressed while they are open.

To illustrate their action we will suppose an air piston is moving toward the end of the cylinder while lowering the skip. If the regulating valve is open the air in front of the piston will be forced back into the inlet pipe. If, however, the engineer trips the valve and the dashpot closes it at any desired point in the stroke, then the air left in the cylinder will begin to compress until it finally passes out through the discharge valves. The arrangement is such, that the further the engineer moves his lever the more air will be compressed and the resistance increased on the air pistons. The air cylinders are only used for regulating the speed while lowering. The usual steam-operated brakes are provided for landing the skip.

To enable the steam pistons to run free while the engine is lowering, the exhaust valves on the steam cylinders are arranged to be released from their connections and remain wide open and stationary until they are hooked up again, when the engine is reversed for hoisting. The releasing and hooking-up mechanism is connected to a small steam-operated thrust cylinder provided to furnish power for this purpose. The operating valve on this cylinder is attached to the reversing gear of the hoisting engine. Therefore, when the engineer reverses his engine the exhaust valves are either released or hooked up again as the case may be, without further attention on his part.

AIR MIXED WITH STEAM FOR HOISTING

While compressed air is usually in demand around a mine, it was decided in the present instance, that it would be best to mix it directly with steam from the boilers and use the mixture in the steam cylinders for hoisting the load. Three large cylindrical drums were installed for storing the compressed air along with the steam. They are each 10 ft. in diameter and 32 ft. long. They furnish ample receiver space at the present time for both steam and air.

Fig. 2 is a diagram of the general arrangement showing how these receivers are connected with the boilers, air compressors and steam cylinders. A 12-in. steam pipe connects the boilers with one end of the receivers. A 16-in. pipe from the opposite end of the receivers is carried to the throttle valve. The 12-in. discharge pipes from the air compressors are connected to this same 16-in. line. This forms a convenient way for the compressed air to reach the receivers when lowering and also to supply the steam cylinders

with pressure for hoisting. A reducing valve is placed in the 12-in. steam pipe between the receivers and boilers. It is set to maintain about 75 lb. pressure on the receivers. The boiler pressure is usually about 125 lb.

PRESSURE AUTOMATICALLY REGULATED.

In explaining the operation of this feature of the hoisting engine, we will say that in the first place the receivers are filled with steam at 75-lb. pressure. The skip is then lowered into the mine. The air compressors begin to discharge compressed air into the receivers to mix with the steam they already contain. By the time the skip reaches the bottom of the mine the pressure will rise to 95 lb., the increase in pressure being due to the compressed air forced in by the descending skip. They will then begin to hoist the load and have 95 lb. pressure to start with. After the skip starts upward the pressure will gradually drop to below 75 lb. as the engine uses up the air stored in the receivers by the previous trip downward. The reducing valve will open after the pressure drops and steam will be taken directly from the boilers to complete the trip upward. When the hoist stops the pressure will rise to 75 lb. through the reducing valve and be in readiness for the next trip down.

The following general dimensions and data are given regarding the hoist:

Diameter of steam cylinders	46 in.
Diameter of air cylinders	36 in.
Stroke of all cylinders	72 in.
Diameter of piston rods	7½ in.
Size of crank pins	12x12 in.
Size of crosshead pins	8⅝x14 in.
Size of main bearings	20x40 in.
Diameter of hoisting drum	15.0 ft.
Length of hoisting drum	15.5 ft.
Capacity of drum	5130 ft. of 1⅝-in. rope
Weight of skip	14,000 lb.
Weight of rock	20,000 lb.
Weight of rope per foot	4.15 lb.
Number of boilers required	2
Capacity of each boiler	200 hp.
Number of feed water heaters	2
Dip of shaft	40°

Berryman feed-water heaters are now being installed. The boilers are of the Lake Superior firebox type with crown and arch tubes.

The engineer handles three levers in controlling this hoist, the throttle lever, reverse lever and brake lever, the same number as on other hoists in this section. The throttle lever, however, usually stands in a vertical position when the hoist is stopped. If he pushes it from him it operates the throttle valve; if he pulls it toward him it acts on the regulating valves on the air cylinders. With this exception the hoist handles about the same as other hoists in the copper country.

ROCK DRILLING CONTESTS PRODUCE NEW RECORDS

Interesting and unusual rock drilling contests took place at Calumet, Mich., Aug. 24. In one of these a single man with an air operated drill had for his competitors a three-man team of hand-drillers. Each party was allowed 15 minutes of actual drilling; at the end of that time the hammer and drill team had drilled 49 in., breaking their record set a few weeks previously at the miners' picnic, by a quarter of an inch. The man with the machine-drill holed through the rock, 60 in., with one minute to spare, winning the prize of $50. The hammer and drill team was composed of the winners of the hand-drilling contest held at the miners' picnic, William Billadeau, Matt Kramerich, and Charles Seppala; the man with the machine drill was John Becker. The rock-drill used was an Ingersoll-Rand, Butterfly valve, one-man machine. Two other contests were held at the same time, which were essentially trials of speed in 'rigging-up' one-man and two-man machines. Each team was required to 'rig-up' its machine, drill for two minutes (to show that the job was a satisfactory one), and then put in a new drill steel.

In the two-man contest there were 20 teams entered, practically every mine in the copper country being represented. The Ahmeek team, composed of Patrick Dunnigan and Archie Paulson, won the first prize of $100, and did the work in 3 min. 42 sec., taking only 1 min. 42 sec. to 'rig up' and put in the drill. The Calumet & Hecla Amygdaloid team won the second prize of $50; the Wolverine team won the third prize of $25.

In the one-man drill contest there were 17 teams entered. The Calumet & Hecla Amygdaloid team won the first prize in 4 min. 33⅗ sec., John Bosio constituting the team. Allouez took second, and Wolverine third. The prizes were the same amounts as in the two-man contest. The two-man drill used was

of Ingersoll-Rand make; the one-man drill was an Ingersoll-Rand Butterfly machine.

The contests in rigging-up drill machines are in line with the recent policy of the Calumet & Hecla M. Co., which is conducting a thorough campaign in efficiency engineering in underground work. It is reported that the expense of changing from the two-man to one-man machines will aggregate a quarter of a million dollars, but such astounding reductions are being attained in cost of driving and stoping that this sum will be made up in the saving of the first year or two. The innovations were first tried out in the Superior mine and were so successful there that they are now being introduced in the other mines of the company.

ALCOHOL TO PREVENT AIR-EXHAUST FREEZING

Alcohol is used to prevent freezing at the exhaust of the air-operated shot drills in use at the site of the new station in New York of the N. Y. C. & H. R. R.R. The New York Central railroad has had occasion to do an enormous amount of core drilling within the last 15 years, and in this work several types of drills have been used. One of the most interesting outcomes of the work is the freezing-prevention appliance that can be readily chine where trouble is experienced from freez- adapted for use on any small air-operated ma- ing at the exhaust.

Alcohol is admitted to a vertical part of the air-supply pipe and close to the machine. The device used for feeding the alcohol is attached to the feed pipe as is a lubricator. It consists of a piece of 1½-in. pipe about 12 in. long, fitted with bushings at the top to take a piece of ½-in. pipe six inches long. The small pipe is closed by a valve. The other end of the 1½ in. pipe is fitted with bushings to take a 3-in. piece of ½-in. pipe, to which a valve and an elbow are attached and into the elbow another short piece of ½-in. pipe is screwed. The threaded end of the last-mentioned pipe is screwed into a hole tapped into the air pipe so that when screwed tight the 1½-in. pipe is parallel to the air pipe.

By opening the top valve, the 1½-in. pipe can be filled with alcohol. That valve is then closed, and, when the machine is operating, the lower valve is opened just enough to permit drops to pass slowly. The admixture of alcohol vapor in the air effectually prevents freezing at the exhaust. The 1½-in. pipe is usually filled with alcohol twice per shift.—*Eng. and Min. Journal.*

FIG. 1.

FIG. 2.

FIG. 3.

PROTECTING TIMBER PILES WITH CEMENT GUN-CONCRETE

Timber piles in marine work in northern Pacific waters are very apt to be attacked by the so-called sand-flea and rapidly eaten away. In a timber wharf for the Seattle Electric Railway Co., at Seattle, Wash., these attacks became so great as seriously to endanger the safety of the structure (Fig. 1), and covering the piles by concrete thrown on from the cement gun was resortd to with considerable success.

Figs. 2 and 3 illustrate the process and the final appearance of the coated piles. Ordinary poultry wire was stretched around the piles and a cement-gun mixture driven against the reinforcement from the nozzle of a cement gun, to a thickness of from 1½ to 2 in. The work was done between tides and the mortar received its set before the water reached it. About 500 piles were coated in this manner at a cost of about $4 per pile.—*Engineering News.*

HAMMER DRILLS IN A TRENCH.

HAMMER DRILLS OPERATED BY STEAM

By P. B. McDonald.*

A contractor in Duluth, while recently excavating a trench 18 in. wide and 4 ft. deep in tough trap rock, found that he was losing money. He had eight drill crews of three men each, who drilled 18 in. per crew per day, or a total of 12 ft. per day. The contractor went to a mining-machinery man to talk it over. Obviously some small "plug" drills were needed. The job did not warrant buying an air compressor, and up to that time plug drills could not be operated by steam, as the valve mechanism expanded with heat and stuck. Besides, the small tortuous ports produced "wire-drawing" of the steam to which compressed air being quicker, was not subject.

Fortunately a new plug drill had just been put on the market which could be operated by steam, due to the advantages of the recently improved "Butterfly" valve. The contractor bought two of these drills and a 3-hp. portable boiler. For the remainder of the job two men, using the plug drills, drilled 6 ft. per man per day, or a total of 12 ft. per day; the other 22 men were dispensed with. The foreman having little to do, attended to the boiler, occasionally throwing in a chunk of coal. The fuel cost was less than $1 per day. The deepest holes drilled during this work were 4 ft., but this was easily done, and 6-ft. holes could have been put down readily. Thus the drills proved to be the solution of what might have been a difficult problem.

Another use of plug drills which is receiving attention, is for secondary work, such as blockholing large masses which have been blasted by means of holes drilled with heavy reciprocating drills. Under the old method, reciprocating machines on tripods were used to put in holes spaced closely enough to break the rock into small fragments, as hand drilling of chunks was slow work. Now it is possible to space the holes put in with the reciprocating drills so as to break large masses and slabs, which can then be broken up readily by plug drills. By this change of policy in breaking rock, higher efficiency can often be obtained.

On the Mesabi range, plug drills are now used in connection with steam-shovel work to break up boulders, hard pan, frozen ground or rock. The steam for operating can be obtained from the steam-shovel boiler. This

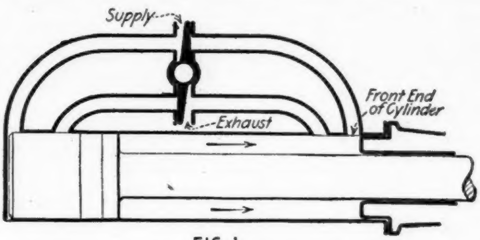


FIG. 1

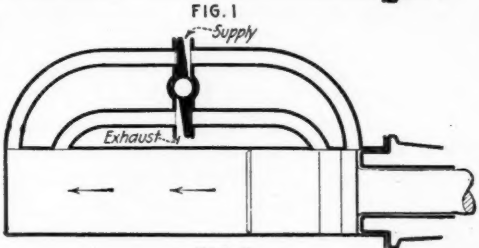


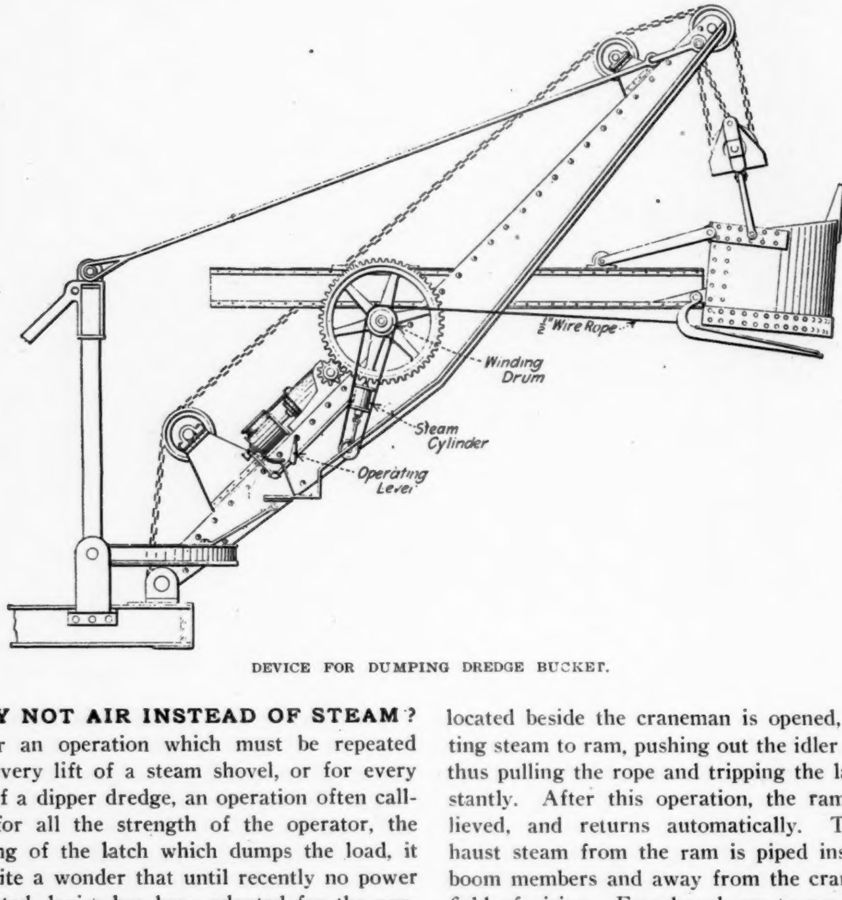
FIG. 2

method is rapidly superseding the old custom of hand drilling in pit work.

The butterfly-valve mechanism is shown in the accompanying drawing. When the valve has flapped to one side as in Fig. 1, the air supply is connected with the back end of the cylinder and the exhaust with the front end. When it has turned to the other end, the con-

*Mining Engineer, Negaunee, Mich.

ditions are reversed. It is evident that the structure of this valve is better adapted for use with steam than are spool and tappet valves, which are likely to stick and which are fed through narrow ports.—*Eng. and Mining Journal.*



DEVICE FOR DUMPING DREDGE BUCKET.

WHY NOT AIR INSTEAD OF STEAM?

For an operation which must be repeated for every lift of a steam shovel, or for every dip of a dipper dredge, an operation often calling for all the strength of the operator, the pulling of the latch which dumps the load, it is quite a wonder that until recently no power actuated device has been adopted for the purpose. The steam trip here shown was adopted only last year on the 95 ton shovels in service on the Panama Canal.

The device consists of a grooved drum of the same diameter as the rack pinion, which is fastened to the end of the dipper shaft and revolves with it. A steam cylinder or ram, carrying an idler sheave on its pushout rod, is bolted to the side of the boom below the engine. The drum carries an idler sheave, a half-inch flexible wire rope from the dipper latch passes over this sheave, over the ram sheave, and is then wrapped around the grooved drum, and the rope-end secured thereto. As the dipper stick runs in and out, the rope is wound on or off the drum at the same speed, so as to maintain the same degree of tautness at all times. To dump the dipper, a three-way cock located beside the craneman is opened, admitting steam to ram, pushing out the idler sheave, thus pulling the rope and tripping the latch instantly. After this operation, the ram is relieved, and returns automatically. The exhaust steam from the ram is piped inside the boom members and away from the craneman's field of vision. For shovels up to 5-yard dippers, a 6x8 inch ram cylinder is used. This size ram gives a pull of approximately 2,800 pounds, which, together with the long stroke, obviates entirely the "hair trigger" adjustment of the latch levers necessary when the old style of handpulled latch is relied upon.

This arrangement works quite successfully, and not only saves the strength and smoothes the temper of the craneman but also secures more rapid manipulation. It certainly would work more satisfactorily if air were used instead of steam. This would apply also to the

dipper shaft engine. The exhaust nuisance would be got rid of entirely and also the condensation troubles which always result when steam driven apparatus is operated intermittently as in this case.

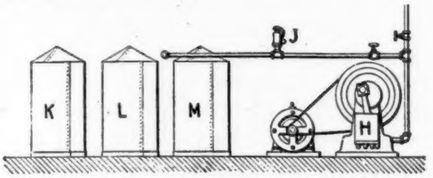


FIG. 1. ARRANGEMENT OF PIPING

EMPTYING AN OIL BARREL

To empty an oil barrel is more or less a troublesome job. We draw our daily supply from three storage tanks for use on gas engines and a supply of oil has also to be placed in the engine crank cases from time to time, to replace that used or drawn off when the machines are cleaned out.

The arrangement shown in Fig. 2 has more than paid for itself; it spills no oil on the floor and eliminates all the strong-arm work of lifting the barrel. It consists of a gooseneck *A* made of ¾-in. brass pipe; the short end acts as a spout and can be inserted into the filling hole in the tank or run into the crank case.

The long end will reach the bottom of the bulge in a barrel when inserted through the bunghole and takes out nearly every drop of oil. A 1x¾x1-in. tee *B* can slide up and down on this leg, making the device adjustable for use in drawing oil out of receptacles having a hole big enough to admit the pipe. A ¾-in. short nipple *C* at the lower end of the tee can be fitted into the barrel bunghole, the thread on the nipple making a joint usually tight enough for the purpose. If the bunghole is large, some waste will make this joint tight. The upper 1-in. outlet is fitted with a reducer *D* and babbitted to fit the brass tube. This serves as a gland, as a little oil makes it slip easily on the tube and at the same time acts as packing. The 1in. side outlet is fitted with a reducer *E* into which a brass tube *F* about 3 in. long is screwed, the outer end being screwed into a brass bushing whose outside is threaded to fit a ½-in. hose coupling *G*.

A small electrically driven air compressor *H* was available which supplied compressed air for starting the engines. A globe valve and a tee were inserted in the line leading to the air receivers, Fig. 1. From the outlet of the tee a line was run over to the oil storage tanks where it connected with a ½-in. hose about 8 ft. long. A globe valve controls the admission of air to this line in which a small pop safety valve *J* with a light spring limits the pressure to about 7 lb.

When a barrel is to be emptied into one of the tanks it is rolled in on the floor and blocked. The gooseneck is inserted through the bunghole and the ¾-in. nipple screwed in to hold it; the brass pipe reaches to the bottom of the barrel and over the tanks *K*, *L* and *M*. The globe valve controlling this line is opened and the compressor is started pumping air into the barrel while the oil flows into the tank. The device requires no further attention until the barrel has been emptied, which is known by the air coming out of the spout.

The safety valve with the 7-lb. spring is an

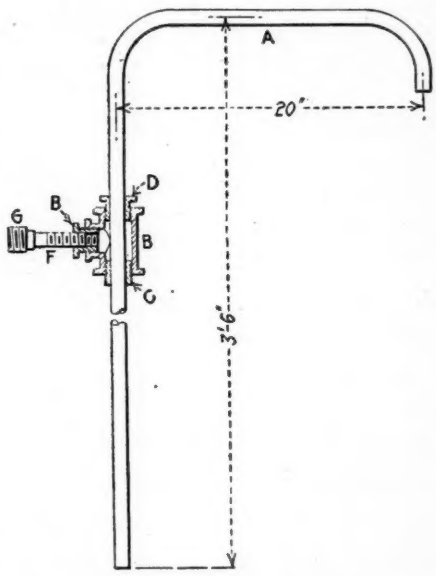


FIG. 2. DETAILS OF AIR-OIL LIFT NOZZLE

important accessory. Some oils are not as fluid as others, and the carrying capacity of the ¾-in. brass goose-neck is limited. With a heavy oil the air pressure may rise rapidly; the safety valve limits the rise to a pressure the barrel can safely withstand and one sufficient to overcome the hydrostatic head of the oil.—*Power.*

USE AND ABUSE OF PNEUMATIC TOOLS

A Pneumatic Tool has a peculiarity over any other operative device, inasmuch as the piston or actual working member of the tool, is not rigidly connected to any other part of the mechanism, but is floating, as it were, in the cylinder and propelled in one direction or the other by the air being admitted at each end of the piston, either by a valve as in the case of Plug Drills and Rock Drills, Hand Facers and Surfacing Machines, or by the piston itself as is the case in Carving Tools. It is for this reason that so little in the way of dirt, cutting of the piston or barrel, or improper lubrication may be sufficient to cause a decided loss in the working efficiency of the tool.

The highly polished, accurately fitted surface of the internal parts of a Pneumatic Tool are particularly susceptible to the action of rust, caused by dampness when not in use, and a tool should never be laid away, even over night without the precaution being taken of inserting a few drops of oil in the inlet, attaching to the hose and running the tool for a second, so that the oil will be carried through by the air and form a thin film on the working parts.

A much better plan, however, and one that is practiced successfully in a large number of plants, is to have a tank large enough to hold all the tools in use filled with kerosene or gasoline, and when the tools are not in service, keep them immersed in the oil. This serves a double purpose; the tools are kept from rusting and the gasoline or kerosene cuts and softens any deposit of oil or dirt in the air passages of the tool that may come from the Compressor. In the morning the tool should be connected with the hose and thoroughly blown out, then disconnected, a little oil (just a few drops) used, and it is ready for operation.

A few drops of oil inserted at intervals of a couple of hours throughout the day should be sufficient. Always use a light, limpid mineral oil, and under no consideration whatever use an animal oil, such as lard oil, sperm, etc., as these have a tendency to gum and clog up the air passages. Many tools coming into the shop for repairs plainly show the ill effects of using animal or heavy mineral oil. Often times it is necessary to boil them in lye water for a number of hours in order to loosen up and remove the deposit of oil and gum in the parts. Even this is not sufficient in many instances, and the removal of a casing and replacement of same is necessary in order to properly clean out the passages.

When a Carving Tool refuses to run, the trouble almost invariably is due to the piston or inside of the barrel having become roughened by a bit of dirt or grit. To remedy this take the tool apart and with a piece of fine emery or crocus cloth, or oilstone, rub the abraded part of the piston smooth. It more often happens that the piston is roughened than the barrel, and if it is found that the barrel has suffered also, take a stick about the radius of the hole and with the emery cloth carefully smooth out the rough place. Then dip the tool in kerosene, blow out thoroughly with air, and put together and it will generally be found to operate satisfactorily. Never put a piston on a grindstone to smooth down a rough spot, as the chances are that the piston will be ruined.

Sometimes difficulty is experienced in starting a new tool, due to the snug fit of the piston in the barrel. In a new tool, when properly fitted, the piston is not more than one-quarter thousandth of an inch smaller in diameter than the barrel in which it works, so you can readily understand why it does not require much dirt in order to cause trouble. It is therefore necessary that the greatest precautions should be taken during this breaking in period, as it might be termed, of a new tool and care and attention paid it until the piston has become worn absolutely smooth, as the least particle of dirt or grit will either cause the tool to stop entirely, or will cut the piston to such an extent that it will be necessary to take the tool apart and dress the piston and barrel as before mentioned. It is for this reason also that a new tool frequently runs warm during the first few days of its use. This fact that a new tool runs slightly warm when first started is rather a point in its favor than otherwise, as it is an indication of a perfect fit of the piston in the barrel, and this running warm will generally disappear after a few days' service.

3/8" hose has come to be regarded as the standard hose for use with Carving Tools. This is correct as far as the size of the hose goes, provided the passage in same is not obstructed by pieces of the inner tube becom-

ing torn and rolling up, or by the use of nipples or fittings in which the openings are too contracted. We have known instances where complaint was made that a tool was not as efficient as it might be, and on examination found the hose in some part of its length to be so obstructed by the rolling up of the inner tube that there was left a passage of an actual diameter of less than ⅛", which size opening will not permit the proper quantity of air to pass through to operate a Carving Tool to its best efficiency.

When attaching a tool to the hose, always see that the nipple is screwed tight into the head, otherwise the jar and vibration will soon destroy the threads on both the nipple and in the head. It is a very good plan to screw a male and female nipple in tight in the head and leave it there, then the threads of the head are protected and the nipple can easily be replaced when worn out. As a matter of convenience, many workmen prefer to use the tools loose on the nipple, which, if the nipple is screwed directly into the head of the tool, will soon ruin the threads, and especially where this is the case the M & F nipple should be used without fail.

Trouble is often experienced due to the hole in the nipples being too small. Never use a nipple with a Carving Tool which has a clear opening through it of less than a quarter of an inch, and the larger it is, the better, as it causes less friction and wire drawing of the air in its passage to the tool. To get the best results from a Carving Tool, or in fact any Pneumatic Tool, the supply of air at the tool should be kept as near as possible at the Receiver pressure, and any contraction or clogging of the passages, either in the hose, nipples or cocks, will cause a lowering of the pressure at the tool, consequently lowering its efficiency. Of course, in work like fine carving, etc., it is necessary at times for the workmen to throttle off the air at the cocks and the above remarks do not apply in this case.

If a tool does not start immediately when the air turned on, some workmen make a practice of striking the nose end violently against the stone or other hard substance in order to start it, which should not be done, as it is apt to injure the tool. In nine cases out of ten it can be started by simply placing the thumb over the exhaust port and removing it suddenly. If this does not start it, insert a chisel in the tool and strike the chisel lightly against the stone.

The bushing in a Carving Tool should not be allowed to become excessively worn before replacing. In many instances where tools are sent in for repairs the bushing has been worn entirely through due to the workmen always holding the tool in one position. Where this condition exists the piston is likely to fracture owing to the fact that the chisel is not held square in the tool and the piston strikes it an oblique or glancing blow.

It would seem almost unnecessary to caution against the use of a pipe wrench on the barrel of a Pneumatic Tool in taking same apart, but the fact that we continually have tools coming into the shop for repairs on which the casings have been ruined, and in many instances the barrel broken or cracked by the use of a pipe wrench would seem to indicate that a few words on this subject might not be wasted. There is no make of Pneumatic Tool on the market at the present time that we know of, on which it is necessary to use a pipe wrench to remove the head. If flats are not provided or if they have worn off so that an ordinary wrench cannot be used on the head and barrel, a proper procedure to follow is to clamp the head in a vise, and with a short piece of ¼" or ⅜" rope, take several turns around the body of the tool and with a stick or a lever through the bight of the rope, unscrew the tool from the head, seeing that the locking pin is properly depressed and there is no mechanical obstruction to the removal of the head except the friction of the threads.

Another point in which economy can be exercised in the use of Carving Tools is to have the proper tools for the work in hand. In other words, do not try to do a heavy rough job with a ¾" or 1" tool, when an 1¼" tool would do it in one-half the time. It will not take long to pay for the extra tool.

One more point, and an important one, that should be observed in the use of Pneumatic Tools, is to see that when the workmen lay them down temporarily they are not thrown indiscriminately into a pile of dirt, as stone dirt and grit finding entrance through the lower end can do just as much damage as if it came through the hose from an unscreened compressor suction. Workmen should also be instructed to thoroughly blow out the hose and see that it is perfectly clean before screwing

the tool on to the nipple, as it is common practice to let the end of the hose drop into the dirt when the tool is unscrewed, and more or less of this will find its way into the tool to the serious detriment of same if this precaution is not observed. Blowing out the hose also answers another purpose, in that it disposes of the water which might have settled in the pipe and hose during its period of non-use.

Chisels used in Carving Tools should receive constant and careful attention. The upper end of the bushing in the tool is provided with a shoulder which acts as a stop for the end of the chisel shank, and the piston is proportioned as to length, so that when it comes down and strikes a chisel held up against this shoulder, the exhaust ports in the upper end of the barrel are opened just the proper amount to allow the air to escape from the upper end and the piston to make a full return stroke. Therefore, it is obvious that the shanks of chisels should be kept square on the end, and full size up to the end. If they are dubbed off on the end, or are so small that they pass up at all beyond this shoulder, they will prevent the piston from making a full downward stroke, the air pressure at the upper end will not be relieved, and the complaint will be made that the tool has lost its power. Of course, after long continued use the shoulder of the bushing will gradually be worn so that it lets the chisel up too far, and the same result of loss of power will be observed, but in this case it is better to send the tool in to the shop for adjustment and repair.

The matter of keeping chisels square and flat on the end is extremely important. When the end of a shank is rounding, the impact of the piston's blow is not distributed over the entire striking surface of the piston as it should be, but is concentrated in one particular spot with a consequent liability of fracturing the piston. As a matter of fact, a far greater number of pistons are broken in this way than there are due to defects in the pistons themselves.

It is, of course, just as easy to make the shank of a chisel hard as it is the piston, and the certain consequence if chisel shanks are as hard, or harder than the piston and do not have a true surface at the upper end, is that the piston must suffer, so it is always good practice to have the shanks of chisels softer than the piston. The proper color or degree of hardness is what is termed pigeon blue.

Point and bush chisels used in Surfacing Machines, and hollow steels used in Rock Drills, are particularly subject to breakage in the shank after a longer or shorter period of use, due in most cases to crystalization of the metal caused by the incessant vibration incident to their use. A way to very effectually curtail this breakage is to periodically, say every two weeks in the case of Surfacing Tools where they are constantly being used, anneal the shanks by heating them to a low red heat, covering up with ashes and allowing them to cool slowly; then after they are cool, reheating and toughening the end of the shank. This annealing process allows the molecules of the metal to assume their original positions or conditions from which they have been disturbed by the constant impact of the piston.

Shanks of chisels used in Hand Facers and Plug Drills should be 2½" long from the end of the shank to the extreme end of the fillet. It is important for the proper operation of these tools that this length be maintained as accurately as possible, as the length of the shank determines the stroke of the piston. In dressing chisels used with Hand Facers, Plug Drills and Surfacing Machines, see that the end of the shank is perfectly flat with a small bevel at the upper edge.

From the point of efficiency it is best to use as short and light a chisel as possible in connection with a Surfacing Machine, as when a long and heavy chisel is used, a large portion of the energy and momentum of the piston or hammer is taken up and absorbed by the inertia of the chisel due to its weight, so that the actual work accomplished would be in inverse ratio to the weight of the chisel. The efficiency of a Surfacer can easily be reduced 25 to 50 per cent. by the use of inordinately heavy chisels, and you can readily see that if this weight of the chisel was carried to an extreme limit, a point would soon be reached where the piston would have practically its whole energy consumed in the chisel, and very little work would be accomplished.

When a Plug Drill, Hand Facer, or Bumper as they are commonly called, or Surfacing Tool stops suddenly, in nine cases out of ten the trouble is something small and unimportant. Outside of the possible breakage of an important part like the piston, the usual diffi-

culty will be found to be either a cutting of the piston or barrel due to dirt or grit, as has been mentioned in connection with Carving Tools, or the stoppage of some port or passage by dirt, or a piece of the rubber lining of the hose. The first thing to do in case a tool of this kind stops is to take it apart and determine if the valve and piston are uninjured and in perfect working order. If this is the case, take a piece of wire and probe the ports in the valve box and barrel, and you will generally find the difficulty. When a tool stops on account of wear, it does not stop suddenly, but gradually falls down in efficiency and at last refuses to run. For a considerable length of time before stopping entirely, however, its efficiency is so reduced as to be readily noticeable.

When a tool of this kind stops from wear the trouble is not as is generally supposed in the valve, but is due principally to wear on the tit of the piston or in the lower end of the barrel where the piston comes through. In the case of Surfacing Machines this would be the barrel bushing, but in Plug Drills and Hand Facers this lower end of the barrel is not removable, and the only cure for it is to send it into the shop and have the barrel and this lower hole lapped out concentrically, one with the other, and have the piston made with a tit to accurately fit the hole. In the case of a Surfacing Tool it is simply a renewal of the barrel bushing that is required and often times the old piston can be used, as frequently the wear occurs more on the barrel bushing than it does on the piston, so that while the barrel bushing may be worn to such an extent that the tool is practically down and out, the tit of the piston may be very close to standard size.

In Plug Drills this difficulty may sometimes be practically remedied by a new piston, as the tit of the old one may be badly worn and a new piston of standard size may reduce the leakage at this point so as to make it for a time a very good working tool, but the proper way is to send it to the shop and have a new piston fitted to the relapped barrel.

To obtain a smooth running Pneumatic Tool it is necessary to properly proportion the amount of air which is allowed to flow to the bottom end of the barrel during the upward stroke of the piston, and this proportioning is obtained by the size of the port or passage leading from the valve box to the lower end. If too little air is admitted, that is, if too small a hole is used, the action of the tool will be slow and sluggish, due to its not obtaining a sufficiency of air or enough pressure at the bottom to raise the piston quickly, and if the hole is too large and too much air is admitted, in the case of Plug Drills and Hand Facers, it will result in a very rough running tool with excessive vibration, while in Surfacing Tools the piston will strike and damage the value box.

This is a lengthy matter to go into and probably would not be very interesting from a practical standpoint, and the only reason we are mentioning it is to illustrate why this wear of the tit of the piston and lower end of the barrel so seriously affects the efficiency of a tool.

Of course, when the tool is new a considerable margin, or as much as is permissible, is allowed in the way of admittance of air to the lower end, so as to counter-balance considerable of the wear, but as the tit of the piston or barrel bushing wears, the leakage becomes such that the port which was properly proportioned when the tool was new, is no longer able to furnish a sufficient amount of air to raise the piston to the top of the barrel. The conseuence is that the stroke of the piston becomes shorter and its upward movement slower, until in the end the leakage becomes so great that the port is no longer able to furnish sufficient air to perform its function.

As an illustration of what this leakage amounts to, we can take for example the large Surfacing Machine tool, the piston of which has a tit 1¾" in diameter. When the tool is new, the tit of the piston is practically an air tight fit in the bottom, or in the barrel bushing, but let the difference in diameter between the tit and barrel bushing be say two thousandths of an inch, this area, taking it around the circumference of the tit will amount to the same area as a hole ⅛" in diameter, so that you can readily see that in addition to the falling off in efficiency of the tool, you are also wasting air which would flow through an opening ⅛" in diameter during one-half of the time of the operation of the tool, and which in horse power at 80-lb. pressure would amount to practically 2 horse power, or 12 cu. ft. free air per minute.

The same conditions which we have men-

tioned regarding wear at the lower end of the piston also applies to the valve, but in a smaller degree. Of course, this wear of the valve will in time effect the tool in exactly a similar manner as that of the piston, but the lower end of the tool is more important inasmuch as it is there that the greatest wear and consequent leakage occur.

One extremely important point in the operation of all valve tools is that of keeping the tool tight. A Hand Facer, Plug Drill or Surfacing Macine Tool should never be operated for a minute after it becomes loose, but should instantly be taken to the repair shop and tightened, or in the case of a Surfacer Tool, time taken to tighten up the clamping bolts. One day's operation of any of these tools running loose will do more damage and harm than three months' use under proper conditions.

Plug Drills should not be run for a single moment without a bit inserted on which the piston may strike. This is the principal reason why a Plug Drill is not suitable, and should not be used for bushing purposes, or for such work as the Bumper or Hand Facer is commonly used. The reasons for this are as follows:—A Plug Drill in order to be efficient as a Plug Drill has a heavy piston and is not provided with a great amount of air cushion at the bottom end, so that when it is operated under conditions where the piston does not strike the chisel, as in the case of bushing, for it is simply impossible to do bushing work without the tool is operating for a considerable portion of the time when the piston is not striking the end of the chisel, the piston of a Plug Drill will in this case hammer the bottom of the barrel and it will not take long to so injure it or upset it that the tool will be in need of repairs.

In a Hand Facer this is overcome by using a lighter piston and more air cushion at the bottom, so that even though these tools are operated without a chisel or bit, the piston does not strike the lower end of the barrel with sufficient force to do any damage. It is for this very reason also that while a Hand Facer will do plug drilling, it will not do it with the efficiency and speed of a Plug Drill.

A Plug Drill piston, if it is allowed to strike the bottom of the barrel for any length of time, will, as mentioned above, not only injure the barrel, but it will take but a very short period for the piston to crystalize at the lower shoulder where it strikes the barrel, causing the piston to break at this point, and it will also be found that under these conditions it is almost impossible to keep the drill tight and in proper running order.

These same points come up in the operation of a Surfacing Machine. A Surfacer Tool should not be allowed to operate under these conditions any more than a Plug Drill, as aside from the crystalization sure to occur in the barrel and piston, this crystalization will also show its effects in the matter of the bolts, clamps, and even in the carriage itself. Many operators of Surfacing Machines are careless in this respect, and a very large portion of the breakages of bolts and clamps are due to this very reason.

Oil is as much a necessity, or more so, in these tools as it is in Carving Tools, due to the much larger wearing surfaces and the higher duty they have to perform.

In regard to repairs when necessary on Pneumatic Tools, it is always advisable to send the entire tool to the shop. For instance, when a valve box is sent in for repairs the factory can only put that particular part in a condition approaching as near as possible to that which it was in when new, but if the factory has the entire tool, it can, when this part is repaired, give the tool a thorough test and determine whether it is O. K. before sending it back. The fact that the parts of a Pneumatic Tool are not independent of each other, but the operation of each depends upon the action of some other part, renders this course necessary in order to have the repairs properly made and satisfaction in the operation of repaired tools guaranteed.

Take as an illustration a Surfacing Tool that has been running loose. The effect in this case is for the valve box to hammer on the top of the barrel, defacing both the valve box and the upper end of the barrel, which point should be and must be air tight. If only the valve box is sent in, it is useless for the factory to grind and refinish the face which comes in contact with the barrel, as not having the barrel to refinish and regrind also, the condition as regards leakage at this point would be as bad, if not worse than it was before.

It is poor economy to operate a Pneumatic Tool as long as it will run or make a noise, as the moment a tool begins to lose in efficiency

(*Concluded on page* 6628.)

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W. L. SAUNDERS, - - - - Editor
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CONTENTS

EMANCIPATION OF MUSCLE BENEFITS ALL

When an efficiency engineer undertakes to raise the standard of performance in a manufacturing establishment he generally finds that he has to distinguish between the things which ought to be better done and those things which ought not to be done at all, at least in the way in which he usually meets them. Time studies of machining operations enable the most efficient rates for the different kinds of work to be determined and permits the introduction of methods intended to bring the efficiency of the entire force up to a close approximation to the determined maximum, with beneficial results to both workman and employer. Changes in the arrangement of work, in the sequence of operations, and in the general planning of the manufacturing end of the business—all these enter into the things in which improvement may be sought. There is one thing, however, in which no effort at improvement should be attempted, and that is in the use of human muscle to lift heavy loads. A man is provided with strength to do things which need immediate attention, directed by individual skill, under proper training and the exercise of brains; but to use this physical strength simply to overcome the force of gravity, as a regular occupation, is one of the things which the efficiency engineer should endeavor to abolish.

It is interesting to note that a continually improving department of engineering work lies in the production of mechanical appliances to this very end. An examination of almost any modern machine shop or foundry will reveal a marked diminution in the number of men whose work is simply to lift and move things about. The labouring gang, formerly very much in evidence, has been replaced by the traveling crane, by the industrial railway, and especially by the overhead tramrail, carrying some type of power hoist.

When the tramrail was first introduced it was employed, as its name indicates, to provide principally a means of enabling a load to be carried about, the lifting being effected by some form of hand hoist. The ease with which power could be applied to such lifting machinery, however, has widely extended its scope, so that in any shop in which compressed air, for example—and there are few modern shops in which this valuable auxiliary is not now used—an air hoist may be used to such

advantage as to render manual labour almost wholly unnecessary for lifting purposes. It is in such methods that some of the most effective developments of efficiency will be found; and when efficiency is understood in its most intelligible definition, that of the reduction of wastes, and applied especially to the reduction of the waste of human energy, the highest returns may be expected. This means that the wasteful human energy should be replaced, so far as possible, by more efficient means.

It has been said that one of the chief characteristics of the coming epoch is that resulting from the manufacture of power, but to this must be included the effective transmission of power to points where it can be used in machines of maximum effectiveness. For this element in the work there is always an opportunity for the use of compressed air, and it is this which drills holes, fills them with rivets, brings the material to the points where it is to be worked, erected and secured; so that the present availability of power in the stored form of compressed air renders some of the most efficient tools of modern work possible.

By the use of such available power the work, not only of lifting loads, but of using the load which is lifted at the point desired at the moment it is wanted, enables the inefficiency of man's muscle to be replaced by the high efficiency of his judgment, and the result is appearing both in the mechanic and in the results of his work.

TOO BAD TO BE TRUE

In a paper upon Lublication read before the West Virginia Mining Institute by L. A. Christian, and printed in whole or in part in various papers, the following occurs:

"At a plant in W. Va. there was an air compressor with one cylinder 24"×26½"/40", guaranteed to compress 1,444 cubic feet of free air per minute with 90 revolutions per minute. This machine worked satisfactorily for about 11 months, then the capacity fell to about 900 cubic feet of free air per minute. On examination it was found that 11 out of 28 discharge valves were incrusted with carbon scale, and that they were stuck and partly open. When the valve caps were taken off the valves were found stuck so fast it was necessary to take off the cylinder head. Then by taking a round piece of hard wood large enough to cover the face of the valve they were driven out of the valve seats. It took four men over four days to get this machine in proper working order. The manager was anxious to know what caused the valves to stick and where the carbon scale came from. When asked what kind of air-cylinder lubricant was being used, his answer was that he was using an 18 cents per gallon engine oil. To get a proper lubrication, that oil was fed through a sight-feed lubricator at the rate of from 5 to 10 drops per minute. It was thought any kind of oil would do. If this company had used a good non-carbonizing oil from the time the machine was put in operation it would have saved nearly a hundred dollars."

We often hear the expression "too good to be true," and there can be little doubt that many times when it is used it aptly applies. There are occasions when "too bad to be true" would apply, and it is not apparent why we should not be as ready to use the one as the other when it will fit the case. If the discharge valves had been stuck as described the compressor would not have delivered any air at all against any customary pressure.

The necessity of using as little oil as possible for air cylinder lubrication, and then of periodically and systematically cleaning the valves and the cylinder interior generally cannot be too much insisted upon, but exaggeration of statement will not help the case.

LONG WATER TUNNEL IN BRAZIL

In the State of Rio, about seventy miles from Rio de Janeiro, there is under construction a water tunnel 4 meters (13 feet) by 4 meters in section which should attract attention, especially on account of its length. It is being built by the Rio de Janeiro Tramway, Light and Power Company, Limited, to carry water from an adjacent water shed to their present reservoir to increase their supply of water and to keep up with the electrical demand of the growing city of Rio. For the present information we are indebted to Mr. D. H. Campbell, Superintendent.

The tunnel is to be 27,650 feet (5¼ miles) long, grade .0023, with two angles in alignment to take advantage of the topographical conditions, one of 57 minutes, the other of 18 degrees 4 minutes. Four shafts and the ends afford ten points of attack, the depths of the shafts ranging from 218 to 375 feet, and at the present writing these are all completed.

A concrete dam 50 feet in height across the Pirahy river is also under construction and a diversion for this river to the tunnel.

The tunnel driving equipment comprises Ingersoll-Rand belt driven compressors, Ingersoll-Rand, Type E 44 Air Drills, Leyner Drill Sharpeners, Root Pressure Blowers and Baldwin Electric Locomotives, all driven from 3 phase, alternating current, transformed from 25,000 volts to 440 volts. The 25,000 volt line is carried 30 miles to the tunnel work from the company's power plant at Fontes.

The labor employed is Spanish, Italian, Portugese and English; the administration is American. Three 8-hour shifts are worked, and a bonus is paid for all progress over 3 meters per day at the rate of 125 Milreis (about $42 in gold) per lineal meter, divided among the three shifts in proportion to the rates of wages.

There are good opportunities on this work for experienced camp foremen and shift bosses who speak English and any Latin language. The labor as a class is good. The climate is healthful, and with 1200 men at work there have been no cases of fever or contagious diseases. Brazil has enormous undeveloped resources, and the success of an American company in developing power, light and traction facilities is indicative of future opportunities and much construction work in various lines.

PIECE WORK

There are many things to be said concerning the advantages of piece work over day labor. With piece work a man's ability is accurately known. The men will not only apply all their skill in doing the work but they will improve their output and learn better and more efficient methods of handling their tools, so that they may work them up to greater capacity. The output can be increased and also better work turned out if the same kind of work is always given to the same man, as men constantly employed on the same kind of work will become more efficient. Cutting piece-work prices shows great ignorance and inexperience on the part of a piece-rate man. It is a sign when some men make more money on their piece-work that they are taking an interest in their work and are hustling and working more efficiently. If their work is done properly they deserve all the money they can make. The chances are if another man was put at the same work he would not be able to make half as much. A man should understand that the price set on a piece of work is satisfactory to the employer, provided, of course, that it has been set properly in the first place, and that what the employer wants first of all is production. It pays the employer to treat the men with consideration and investigate their complaints, if any are made, and it may be necessary at times to raise a price to take care of certain unforeseen conditions on account of the hundreds of little things which have to be considered. If everything is given proper consideration there is no reason why the straight piece-work system should not be looked upon with favor by the employee, since through it he can make more money.—*T. F. Keane before the Master Blacksmiths' Association.*

THE FLOW OF PEOPLE

The following, which should be especially suggestive to the readers of Compressed Air Magazine appears in an editorial department of a recent issue of Cassier's Magazine.

There is probably no one problem in engineering which has demanded and received more attention than that involving the proportions and construction of channels and conduits for the conveying of fluids of various kinds from one point to another. For three hundred years and more the flow of water in channels and pipes has been studied, and every detail of surface friction, eddy resistance, internal work, and mean velocity has been examined theoretically and practically. In like manner the flow of air and of gases has been investigated, and it is practicable, with the information available and tabulated, for almost any engineer to compute the capacity of a given system of piping, or to plan a combination of channels to meet definite requirements. When several pipes are intended to deliver their contents into a main collector, the rules for proportioning the various sections are readily applied so that there shall be no undue obstruction to the flow, and the several velocities may be combined in a manner which permits the least practicable resistance to be imposed upon the movement of the entire mass.

These facts are so well known and so generally appreciated that any discussion of them in this place may seem so elementary as to be unnecessary, but it is the very completeness of our knowledge relating to the mechanical flow

of inanimate substances which renders almost inexplicable the lack of practical application of the same principles to the flow of human individuals. A fluid is nothing more than an aggregation of molecules capable of a certain degree of mobility among themselves, and it will take a very moderate amount of observation of a mass of people to render it clear that such a crowd is subject to laws similar to those governing the motion of steam, water, or air. If a crowd of people approaching and passing through a narrow entrance be observed from above, it will be distinctly apparent that the flow of the human particles is almost identical in character with that, for example, of sand through the contraction of an hour glass. If such a crowd, while waiting, has a center of disturbance created within it, the concentric waves of agitated humanity will be perceived extending far beyond the cause of movement or beyond the direct knowledge of the human molecules.

Under such circumstances it is most curious that more attention has not been given to the laws governing the flow of people, in connection with the proportioning of streets, passages and various conduits through which the great currents of humanity are compelled to pass, and it is one of the educational problems of the immediate future to instruct engineers, architects and administrators in the important matter of the avoidance of artificial congestion, by providing rationally designed routes of travel.

At the present time there appears to be a surprisingly small amount of reliable information available upon the subject. How many architects know the capacity of a staircase, or the possibilities of a doorway, in terms of a definite flow of people in a given period of time?

What is the resistance of a certain contraction in a passage, or the frictional opposition of a sharp corner or a projecting buttress? Probably the builders of passenger elevators are in possession of experimental data concerning the capacity of such machines, but such information is sufficiently valuable to be kept for the use of those who have been wise enough to acquire it. These and similar points must soon become essential in the development of the city, the railway station, and the public building of any kind, and it is extremely probable that the greater the degree of fullness with which the information is secured, the closer the laws will be found to approximate those already ascertained for inanimate fluids.

One thing is evident, at least, the basic principle of efficiency in the movement of people, as with other things, will be found to lie in the maintenance of continuity of flow. Any interruption or any marked check to flow introduces such a degree of loss as to render it most undesirable, and in most instances a moderate average rate of flow, if uninterrupted, will provide a much greater capacity than an intermission of stoppages and spurts of high speed. The time is ripe for a study of the flow of people, and it is a problem of vast interest, both to the engineer, by whom it must be directed, and to the people themselves, who are even more closely concerned.

USE AND ABUSE OF PUNEUMATIC TOOLS

(*Concluded from page* 6624.)

and cutting power, you are not only using more air, which is an insignificant item comparatively speaking, but you are really wasting the time of a high-priced man in operating this tool. It is a very easy matter to lower a man's efficiency by 25 per cent. in using a tool that should have gone to the repair shop some time previous.

While this paper is prepared with a view of touching on Pneumatic Tools only, we have seen so many instances of bad practice in regard to the installation and operation of Air Compressors that we feel that a few words will not be out of place.

We urgently recommend that in all plants particular attention be paid to the intake of the air compressor. Air should never be taken from a room where stone-cutting is being done as the air is filled with fine particles of grit, which are, in cases of this kind, constantly drawn into the Compressor and forced through the tools, with a consequent continuous grinding or cutting action. The ideal arrangement for a compressor intake pipe is to run it out through the roof of the shed and enclose the end of it in a framework two or three feet square covered with a couple of thicknesses of fine muslin.

When the plant is being installed, nothing but new clean pipe should be used for conveying air to the tools. Every piece of pipe should

be stood on end and hammered to jar loose any scale that may be on the inside, and every fitting should be inspected to see that it is perfectly clean. If old rusty pipes and fittings are used, you will have endless trouble and annoyance from dirt and scale coming through the pipes and hose to your tools. These precautions will give a supply of cool, clean air, and the effective working life of the plant will be increased 100 per cent. over what it will be if installed and operated in the slipshod, slovenly manner that many plants are.—*Granite, Marble and Bronze.*

TO BLOW ITSELF ALONG

The recent successful application of a propeller working in the air as a means of propulsion both for a road vehicle and for a canal barge has been followed by some interesting experiments by French officers in Algiers with a kind of sledge mounted on six wheels, driven by a 50-horsepower motor, and similarly equipped with a propeller. This vehicle, which carries three persons, travels easily over the rolling sand at a speed of 12 to 18 miles an hour, and is said to be able to climb gradients of one in five. It is believed that this new means of transport will solve many of the difficulties of communication in the Sahara, and it is hoped by fitting it with wings not only to facilitate its progress, but to enable it on occasion to leap over obstacles in its path.

NOTES

The cranks whose senseless agitation has eliminated the public drinking cup, even in Pullman cars, have inflicted much discomfort upon ordinary people and have largely increased the business of saloon keepers. The victims that deserve the greatest pity are the poor immigrant children who have need to make long journeys in hot dusty cars. When this pernicious movement against free water drinking has passed, people will wonder at the blindness which enabled cranks and saloon keepers to spread so much discomfort among honest people.—*R. & L. Engineering.*

At the Cinderilla Consolidated mine, on the Rand, large quantities of sand are sent down for filling. At first attempts were made to send the sand down wet in pipes, but owing to the wear of the pipes, and the great cost of pumping 4000 ft., this method was abandoned. The sand is now sent down dry through a wooden shute about 12 in. square, and jets of compressed air are used at the bends to assist.

A hydrogen pipe line has been built in Germany, to carry hydrogen from a chemical works to the dirigible-airship station, near Frankfort. The pipe line is about three miles long, and is operated under a pressure of about 40 in. of water. Nearly the whole of the line is welded, couplings being used at long intervals only.

The first shaft to be put down by the freezing process was the Archibald Lignite Colliery, at Schneidlungen, Germany, in 1883. Until quite recently, sinking to a depth of from 300 to 500 ft. has been regarded as something extraordinary, but a German shaft has been successfully put down to a depth of 990 ft., about 820 ft. of which was quicksand and thin beds of sandy clay. There are now other shafts in the course of sinking by this method that will be nearly 1500 ft. in depth.

Prof. Willis L. Moore, chief of the Weather Bureau, speaking on "The Story of the Air," said that the floods of the Mississippi were not due to the cutting down of the forests, but to air conditions. "As long as we have the Gulf of Mexico to the south of us," said Chief Moore, "we shall have floods, because the warm air coming up from the Gulf, meeting the cooler air from the north, causes condensation and rain."

Works are now about completed at Alexandria, near Sydney, New South Wales, by the British Oxygen Company, Limited, London, for the production of pure oxygen by the liquid air process. The present plant—which is considered a small one—produces 17,000 cubic feet of oxygen per day. The plant is driven by a Diesel engine, which develops from 80 to 100 brake horse power, the engine being placed about the middle of the machinery. Air is compressed by a four-stage, belt-driven compressor.

Experiments made with a view to bringing aluminium to a liquid condition capable of being spread when cold over any dry surface, have, according to statements in the German

press, been crowned with success. The composition is applied like paint with a brush, and gives an appearance similar to dull silver coating. It is said to be an excellent rust preventive, possessing resistance to heat up to 500 deg. Cent. It is also stated to be elastic, durable, proof against atmospheric influences, and a perfect substitute for tin in plating.

In the Transvaal mines, South Africa, according to the government mining engineer, in 1910 there were 257 compressors, with 100,291 hp. No separate returns of the value of air compressors were rendered to the department. The gold mines in the Johannesburg consular district employ on an average three 50-drill compressors on each mine for driving the drills. Up to about two years ago the air compressors were almost entirely driven by steam, but since then electric power has been furnished to nearly all of the mines, and steam power for air compressors has been superseded by electricity.

Cleaning water mains with mechanical scrapers at Halifax, has been responsible for a considerable increase in the hydrostatic pressure at hydrants. In a paper before the meeting of the Union of Canadian Municipalities on Aug. 28, Mr. F. W. Doane, City Engineer, stated that in one case the average pressure on 25 hydrants increased from 34.2 to 54.4 lb. per square inch as a result of cleaning. In another district there was a pressure of 19 lb. after cleaning where before there had been no water at all.

The greatest depth yet found in all the oceans was discovered recently by a surveying ship of the German navy about forty miles off the north coast of Mindanao, near the Philippines. Here soundings showed 9,780 meters or a depth of six miles plus 406 feet. The greatest depth heretofore known was a spot south of the Island of Guam, discovered in 1901 by the U. S. cable steamer Nero. Here a depth of 9,635 meters or a little less than six miles was found.

Need for a general knowledge of mineralogy by working miners was evidenced recently by the discovery of a 6-in. seam at the Lady Rose mine, Victoria, Australia. The miners regarded the material as worthless, since there was no indication of gold in it, and large quantities of it which had been broken were discarded as worthless. A visiting engineer recognized the material as scheelite, of remarkably good quality, worth $400 per ton, much more than the gold-bearing quartz the miners were seeking.

Another pit sinking record has been established in connection with the Doncaster, England, coalfield. On Saturday, September 14th, the sinkers employed at the new colliery being sunk at Askern Spa, near Doncaster, by the Askern Spa Coal and Iron Company, reached the Barnsley seam of coal at a depth of 565 yards. In No. 1 shaft the seam is 9 ft. thick and of excellent quality. Sinking was commenced only last December, so that the progress made has been remarkably rapid, the average having been 14 yards per week. Seventy-six yards of tubing had to be placed in each shaft to dam out 4000 gallons of water per minute.

A company (Det Norske Nitridaktieselskab), with $2,700,000 fully subscribed capital, has been formed in Christiania to produce sulphate of ammonia from the atmosphere after the method of an Austrian engineer, Dr. Serpek. The invention has been developed by a French company, Société Generale des Nitrures, and the patent right for Norway has been acquired by Det Norske Aktieselskab for Elektrokemisk Industri. The new company has been started jointly by French and Norwegian interests. Construction of the mill will commence immediately at Arendal, operations to start in the autumn of 1914. At first 10,000 hydroelectric horsepower will be used to be increased later to 25,000. The power will be supplied by A/S Arendals Fossekompani. The annual output is calculated to exceed 40,000 tons of sulphate ammonia.

A successful trial trip has been made by the first motor ship built at Kiel for trade between the east coast ports of North and South America. The vessel has a length of 350 feet, with a beam of 50 feet and a depth of 27 feet, but the chief interest lies in the fact that this is the first large cargo boat for trans-Atlantic trade to be fitted with two-cycle Diesel motors. Each of the two main engines has four cylinders with a bore of 18.5 inches and a stroke of 26.77 inches, and together develop about 2,000 indicated horsepower. They are of the cross-

head type, and the air-compressors and scavenging pumps are driven directly off them, as also are the bilge, fuel, lubricating oil, and other pumps. In addition there are an air compressor and a dynamo, both driven by 50 horse-power Diesel engines, and a smaller dynamo worked by steam, which is supplied by an oil-fired boiler on deck. The deck machinery is driven by steam, which can also be used alternatively to compressed air for the steering gear.

Milking machines, employed in New Zealand about four years ago, and since then much improved and developed in Australia, are coming into general use there, saving much time and labour for those engaged in dairying. The American Consul at Sydney says that demonstrations of these machines have been amongst the most interesting and popular features of agricultural shows in Australia, and he calls attention to several records of over one hundred cows being milked by these machines in less than two hours. The machines not only possessed the advantage of speed and economy, but also rendered the milking operation cleaner and more sanitary than when performed by hand. These machines are all made and worked on the natural principles of suction and compression, copying nature in the calf as closely as possible.

LATEST U. S. PATENTS

Full specifications and drawings of any patent may be obtained by sending five cents (not stamps) to the Commissioner of Patents, Washington, D. C.

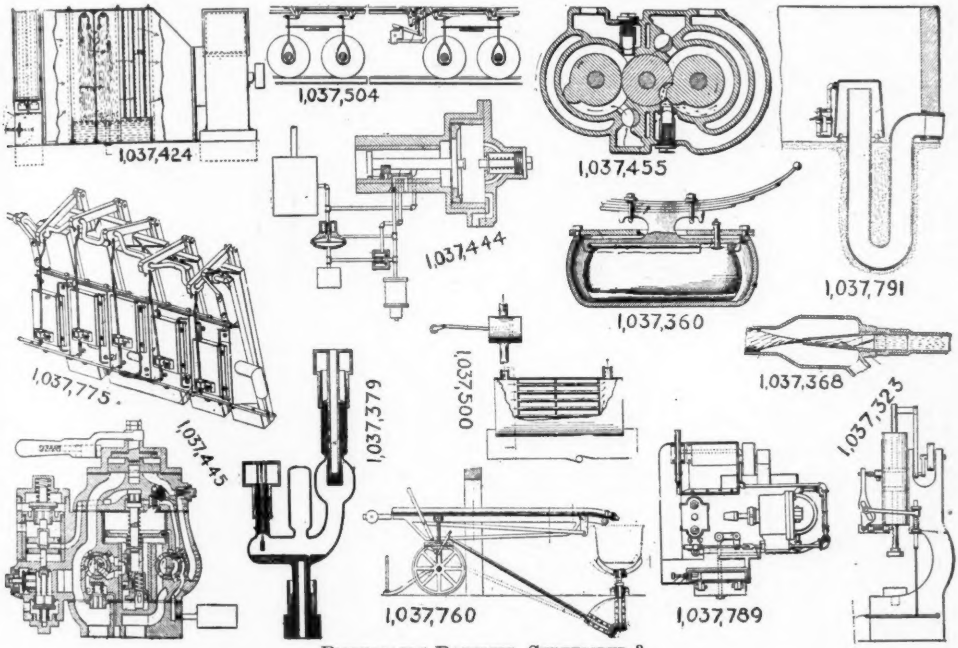
SEPTEMBER 3.

1,037,323. PNEUMATIC HAMMER. Griffith D. Roberts, Columbus, Wis.

1,037,360. PNEUMATIC SUPPORT FOR VEHICLES. Charles J. Stovel, San Francisco, Cal.

1,037,368. VACUUM-CLEANER. Edgar B. Symons, Milwaukee, Wis.

1,037,379. VACUUM APPARATUS. Ezechiel Weintraub, Lynn, Mass.



Pneumatic Patents, September 3.

1,037,424. APPARATUS FOR PURIFYING AIR. William G. R. Braemer, Buffalo, N. Y.

1,037,444. MAINTAINING DEVICE FOR AIR-BRAKES. Murray Corrington, New York, N. Y.

1,037,445. FLUID-PRESSURE-BRAKE APPARATUS. Murray Corrington, New York, N. Y.

1,037,455. AIR-COMPRESSOR. Victor J. Diefenderfer, Allentown, Pa.

1,037,500. OZONIZER. Ross M. Leggett, Ann Arbor, Mich.

1,037,502. APPARATUS FOR LOCKING CAR-DOORS. Joseph B. Lowell, Everett, Mass.

1,037,504. AUTOMATIC TRAIN-STOP. James W. McKelvey, Lawrenceville, Ga.

1,037,535. FLUID-OPERATING TOOI. Charles B. Richards, Cleveland, Ohio.

1,037,548. APPARATUS FOR DRYING HAIR. Ida Scholz, Altena, Germany.

1. Apparatus for drying hair comprising in combination a hot water vessel for drying the hair from below and a second hollow vessel adjacent to said hot water vessel, means for driving a current of air through said second vessel,

and means for directing the thereby heated current of air on the hair on said vessel, substantially as set forth.

1,037,586. APPARATUS FOR COMPRESSING AIR AND OTHER FLUIDS. Ernst Birawer, Berlin, Germany.

1,037,760. SAND-BLASTING APPARATUS. Harvey B. Heaslet, New Brighton, Pa.

1,037,789. FLUE-EXPANDER. John Thos. McGrath, Battle Creek, Mich.

1,037,791. ADJUSTABLE VENT FOR SIPHONS. Samuel F. Miller, South Orange, N. J.

1,037,830. MACHINE FOR CEMENTING BRUSH-BRISTLES. Hugh P. McMillan, Baltimore, Md.

1. In a cementing apparatus the combination with means to clamp the work, of means for forming a seal about that part of the work where the cement is to be applied and traveling means movable along the clamped work for supplying air under pressure to the sealed portion of the work.

1,038,059. BRAKE-SHOE CONTROL. Luzian Zink, Detroit, Mich.

1,038,065. OXYGEN-GENERATOR. Newton J. Anderson, Coffeyville, Kans.

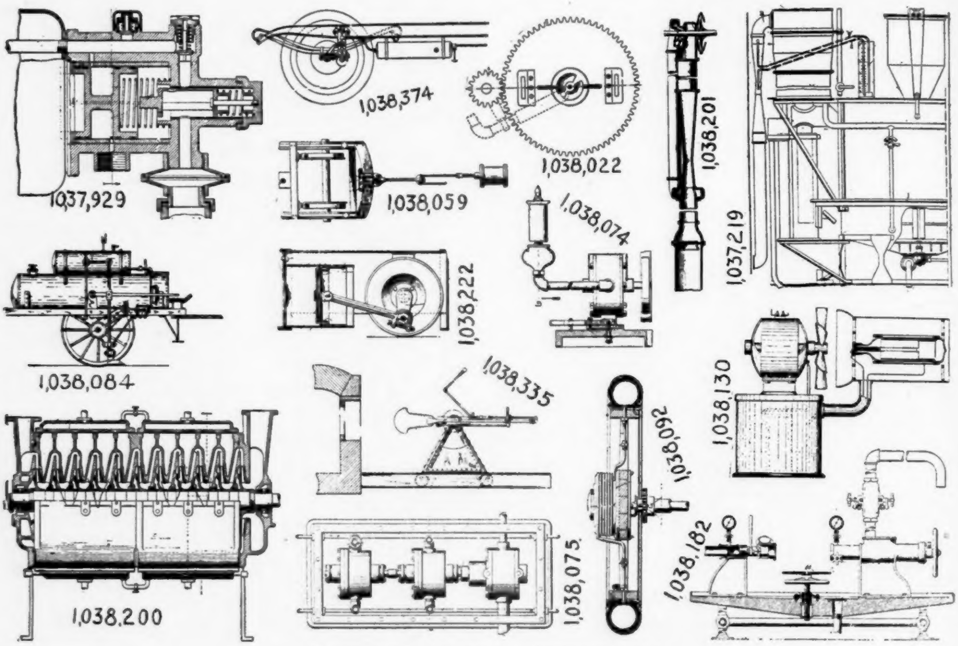
1,038,074. POWER-WHISTLE. Reinold Berrenberg, Boston, Mass.

1. A signaling device, comprising a base, a rotary air compressor pivotally mounted on said base and having a driving pulley, a power whistle connected to said air compressor, and a lever arranged to swing the air compressor about its pivot to bring its pulley into driving relation with a power operated wheel.

1,038,075. VACUUM-PUMP APPARATUS. Reinold Berrenberg, Boston, Mass.

1,038,084. APPARATUS FOR TREATING SOIL. Frank C. Carroll, Cleveland, Ohio.

In apparatus for treating the soil, in a vehicle, a solution tank mounted thereon, an air tank also mounted on said vehicle, means for supplying compressed air to said tank, an atomizer connected to the air tank and solution tank,



Pneumatic Patents, September 10.

SEPTEMBER 10.

1,037,894. HOT-AIR HEATER. John H. Garner, Kingwood, W. Va.

1,037,919. PROCESS OF MANUFACTURING HYDROGEN. George Francois Jaubert, Paris, France.

1,037,929. AIR-BRAKE VALVE. Jacob B. Knudsen, Chicago, Ill.

1,038,022. PNEUMATIC COOLING DEVICE. Herman T. Sundstrom, Houston, Tex.

1. A device of the character described including the combination with a disk having an air chamber in the face thereof, of molds carried by said disk, a plate secured upon said disk and covering said air chamber and having an aperature therethrough communicating with said chamber, air outlets leading from said chamber and discharging against the molds carried by said disk, and an inlet tube secured to said plate and communicating with the air chamber through the aperature therein.

1,038,049. SUCTION AND PRESSURE DREDGER. Pieter van Wienen, Cologne, Germany.

a distributing device leading from said atomizer to a point near the ground, and a distributing tooth comprising a shank swiveled to the distributing pipe, an inclined upper portion, and a receiving chamber under said upper portion and provided with discharge openings adapted to direct the discharge in lateral inclined directions.

1,038,092. COOLING DEVICE FOR PNEUMATIC TIRES. Andrew B. Craig, Tarkio, Mo.

1,038,130. APPARATUS FOR PRODUCING OZONE. Siegfried Held, Chicago, Ill.

1,038,182. FLUID-METER TESTER. Philip Mueller, Decatur, Ill.

1,038,200. MEANS FOR COOLING TURBO COMPRESSORS OR BLOWERS. Auguste Camille Edmond Rateau, Paris, France.

1,038,201. MEANS FOR INCREASING THE HEIGHT OF SUCTION OF PUMPS. Auguste Camille Edmond Rateau, Paris, France.

1,038,222. PUMP FOR VACUUM-CLEANERS. Robert R. Smith, Philadelphia, Pa.

1,038,285. CAPSULE OR CONTAINER FOR COMPRESSED OR LIQUIFIED GASES. ROBERT HUNTER CAMPBELL, Edmonton, England.

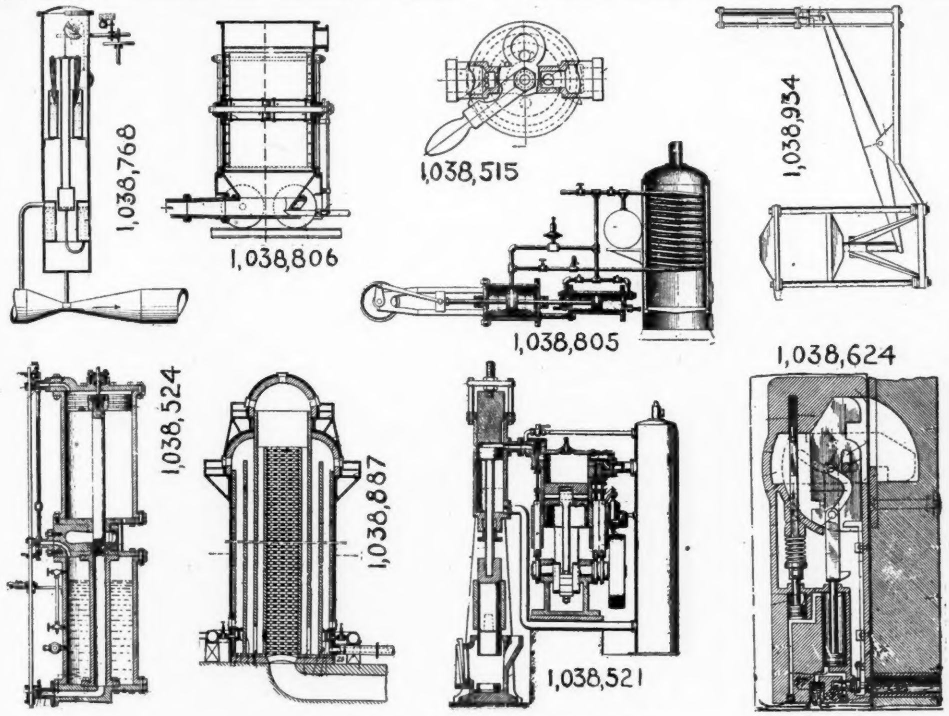
1,038,335. MACHINE FOR BLOWING GLASS CYLINDERS. JOHN FORSTER, St. Helens, England.

1,038,374. COMBINED AIR-COMPRESSOR AND SHOCK-ABSORBER. JOSEPH D. JACKSON, Washington, Pa.

SEPTEMBER 17.

1,038,515. ATTACHMENT FOR STEAM-LOCOMOTIVES. HALSTEAD T. AYDELOTT, Birmingham, Ala.

1. A locomotive attachment comprising a controller valve adapted to be located in the cab, means to supply fluid pressure to said valve, a blower pipe for the locomotive, a fluid pressure controlled valve for controlling the flow of fluid pressure to the blower pipe, separate fluid pressure pipe lines leading from said controller valve and adapted to deliver fluid pressure to operate respectively a bell ringer and said fluid pressure controlled valve, there being a port in the casing for said controller valve for each of said pipe lines, and there being ports in the movable member of the controller valve adapted to simultaneously control the fluid pressure conditions in said several pipe lines, as and for the purposes described.



PNEUMATIC PATENTS, SEPTEMBER 17.

1,038,521. PNEUMATIC ORE-STAMP. HANS CHARLES BEHR, Johannesburg, Transvaal.

1. In a percussive apparatus the combination of a cylinder provided with an extension; a reservoir of compressed air in communication with said extension; a piston in said cylinder; a stamp head associated with said piston; means comprising an operating piston and cylinder whereby air of greater pressure than that in said reservoir may be delivered to one side of said piston; and means whereby the pressure on said side is prevented from remaining below that in said reservoir during the downward stroke, substantially as described.

1,038,524. GENERATOR OF HYDRAULIC POWER FOR PRESSES, &c. ALBERT T. BOSSERT, Kansas City, Mo.

1. In a generator of the character described, a low-pressure cylinder containing motive fluid, an intensifier cylinder containing motive fluid and arranged within the said low-pressure cylinder, a valve to admit pressure to the low-pressure cylinder to force fluid therefrom, an intensifier plunger to force the fluid from the intensifier cylinder, and means to conduct the motive fluid to the point of use.

1,038,624. PNEUMATIC DOOR-LOCK. JOHN C. MESSICK, San Rafael, Cal.

1,038,691. APPARATUS FOR GENERATING HIGH-PRESSURE OIL-GAS. RUDOLPH VUILLEUMIER, New Rochelle, N. Y.

1. An apparatus adapted to produce high candle-power gas under high pressure, combining a generator, means for internally heating the same, a pre-heater, means for introducing oil through said pre-heater into said internally heated generator, means for removing the resultant fixed gases through said pre-heater, and means adapted to maintain throughout said apparatus a pressure of approximately fourteen atmospheres.

1,038,761. PNEUMATIC PIANO-PLAYER AND THE LIKE. MACARIUS MAXIMILIAN KASTNER and CONRAD KATZ, London, England.

1,038,768. FLUID-METER. JOHN W. LEDOUX, Swarthmore, Pa.

1,038,781. SAND-BLAST. JAMES C. MYLES and HAROLD GIRVIN, San Francisco, Cal.

1,038,801. MEANS FOR INDICATING THE DEFLATION OF PNEUMATIC TIRES. FRANCIS H. TREAT, Cleveland, Ohio.

1,038,805. HOT-AIR ENGINE. SAMUEL J. WEBB, Minden, La.; Robert D. Webb, Minden, La., by inheritance and by mesne assignments owner of entire title.

1. In a hot air engine, the combination of an air compressor, a motor adapted to be operated by air compressed by the compressor, the latter connected to be operated by the motor, a conduit between the outlet of the compressor and the inlet port of the motor, means for heating the air passing through said conduit, and a by-pass connection between the compressor and motor permitting the cold air when the pressure is excessive to pass between the compressor and motor without going through the heater, substantially as set forth.

1,038,806. APPARATUS FOR HANDLING CONCRETE. RUDOLPH WELCKER, Yonkers, N. Y.

1. In an apparatus for handling concrete and the like, the combination of an air tight casing having side walls sloping downwardly and inwardly and terminating in an elongated channel extending lengthwise of the bottom of the casing; an outlet conduit at the exit end of the channel; an air supply pipe at the rear end of the channel and so disposed as to deliver a blast of air lengthwise of the channel; and means above the sloping walls for dropping small masses of concrete upon said walls for direction thereby into said blast of air.

1,038,887. AIR-BLAST HEATER. EDMUND HOHMANN, Stettin, Germany.

1,038,934. COTTON-COMPRESS. MARSHALL M. MODE, Cameron, Tex.

SEPTEMBER 24.

1,039,081. WAVE-MOTOR. FRANCIS C. BATES, San Jose, Cal.

1,039,148-9. APPARATUS FOR REFRIGERATING AND DRYING GASES. CHARLES H. LEINERT, Chicago, Ill.

1,039,173. PRESSURE CASTING APPARATUS. ALBERT WOOD MORRIS, Philadelphia, Pa.

1,039,185. FLUID-PRESSURE APPARATUS FOR OPERATING BULKHEAD AND OTHER DOORS. FREDERIC JOHN PIKE, Beckenham, and HERBERT NEVILLE, Forest Hill, England.

1,039,209. VACUUM CISTERN-CLEANER. HOWARD STUCKER, Shawnee, Okla.

1,039,221. LOCOMOTIVE-BRAKE. WALTER V. TURNER, Edgewood, Pa.

1,039,222. BRAKE-VALVE DEVICE. WALTER V. TURNER, Edgewood, Pa.

1,039,231. NOZZLE FOR APPARATUS FOR EXHAUSTING, PROPELLING AND INDUCING CURRENTS IN FLUIDS. GOTTFRIED WEIDMANN, Zollikon, near Zurich, Switzerland.

1,039,234. PRESSURE CASTING APPARATUS. SAMUEL PRICE WETHERELL, JR., and ALBERT WOOD MORRIS, Philadelphia, Pa.

1,039,243. STERILIZER. ROBERT P. BARNSTEAD, Boston, Mass.

1,039,264. PNEUMATIC BLOW-OUT FOR ELECTRIC SWITCHES. EDWARD H. DEWSON, New York, N. Y.

1,039,335. AUTOMATIC SPRAYING APPARATUS. AARON J. TYLER, Rochester, N. Y.

1,039,393. DOOR-OPERATING MECHANISM. THOMAS J. HERON, Pittsburgh, Pa.

1. Door mechanism of the character described, comprising a system of pressure pipes or conduits having branches extending to the different doors to be opened, means for normally supplying pressure to said pipes or conduits, means for effecting a reduction of said pressure from any one of a number of different points, and door opening devices rendered operative by such reduction of pressure; substantially as described.

1,039,537. PNEUMATIC CUSHION. JOSEF HOFMANN, Baumaroche, Switzerland.

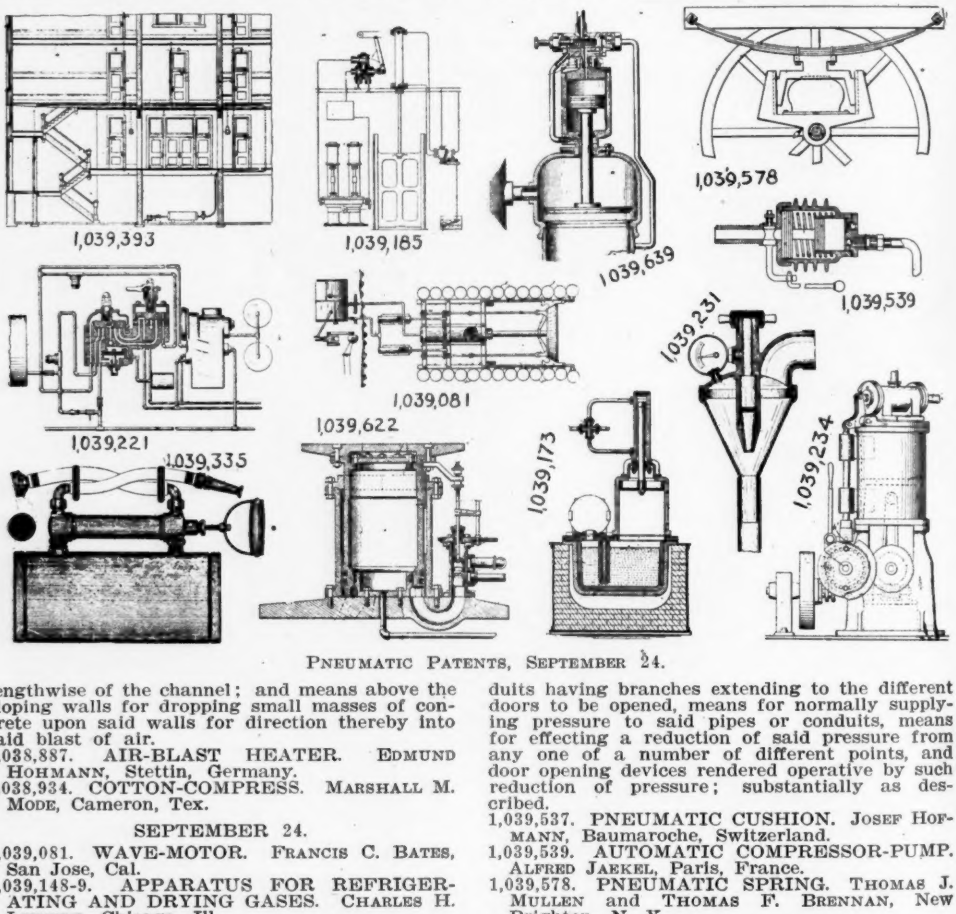
1,039,539. AUTOMATIC COMPRESSOR-PUMP. ALFRED JAEKEL, Paris, France.

1,039,578. PNEUMATIC SPRING. THOMAS J. MULLEN and THOMAS F. BRENNAN, New Brighton, N. Y.

1,039,622. MACHINE FOR JARRING SAND MOLDS. EDGAR CLARENCE WILEY, Lynchburg, Va.

1,039,639. FLUID-PRESSURE REGULATOR. JOHN J. BODWIN, McKeesport, Pa.

1,039,678. VALVE MECHANISM FOR JARRING-MACHINES. EDGAR C. WILEY, Lynchburg, Va.



PNEUMATIC PATENTS, SEPTEMBER 24.